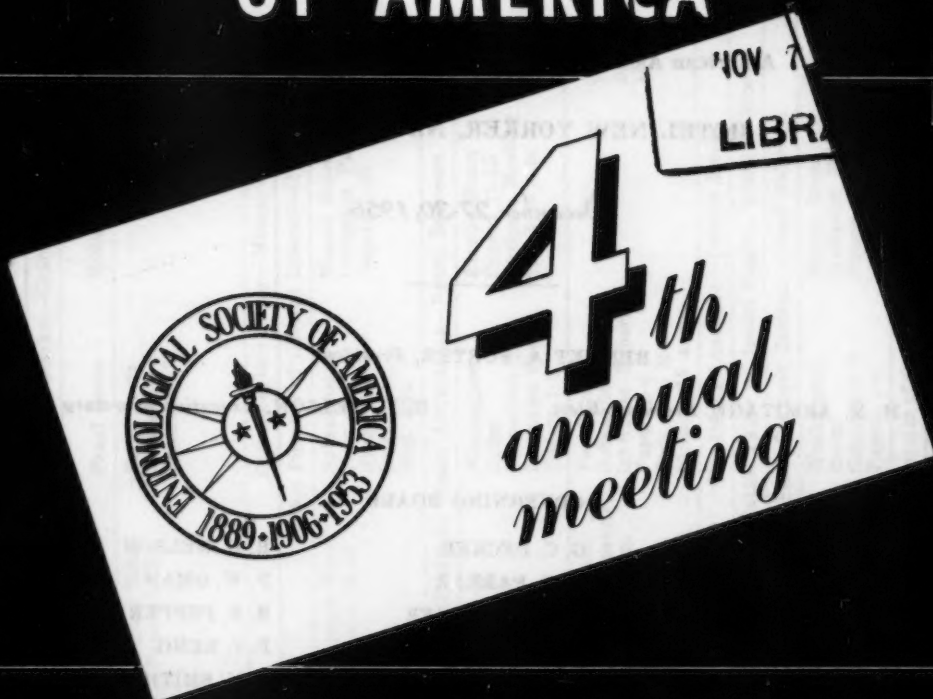


Bulletin of the  
**ENTOMOLOGICAL SOCIETY  
OF AMERICA**



*Published by the*  
**ENTOMOLOGICAL SOCIETY OF AMERICA**

FORMED IN 1953 BY CONSOLIDATION OF THE  
AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS (1889-1952)  
AND THE FORMER ENTOMOLOGICAL SOCIETY OF AMERICA (1906-1952)

VOLUME 2

**SEPTEMBER · 1956**

NUMBER 3

## AUTOGRAPHA O O

ENTOMA, 11th Edition is out. Paper bound \$1.00; cloth bound \$3.00. Order your copy from E. H. Fisher, Editor, Department of Entomology, University of Wisconsin, Madison 6, Wisconsin.

ANNUAL REVIEW OF ENTOMOLOGY, Volume 2. You received an order blank with your presidential ballot. Please return it to the Washington office as soon as possible, certainly before December 1. You may place a standing order if you wish.

INDEX OF AMERICAN ECONOMIC ENTOMOLOGY, NUMBER XIV. You also received an order blank for this INDEX. Your order will be filled as soon as it is received in Washington.

PROGRAM OF ANNUAL MEETING. It is hoped that publication of the program of the annual meeting in this issue of the BULLETIN will meet with the approval of the membership. In this way all members will see

the program ahead of the meeting and, where necessary, can use it in clearing travel authorization. A gratis copy will also be available at the meeting. Entomologists are sometimes accused of a lack of culture (you define it!). This year we meet with the A.A.A.S. which will give us an opportunity to broaden our cultural outlook. For hotel reservations write to Front Office Manager, Hotel New Yorker, 34th St., at 8th Ave., New York 1, N. Y. Mention the meeting of the Society. Give expected time and date of arrival and departure. All rooms with bath. There is a 5 percent New York City hotel-room tax.

Single room .....	Per day \$6.00 to \$14.00
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ARTICLES REPRINTED. The papers by M. P. Jones and G. S. Fichter in this issue of the BULLETIN are reprinted here because we thought both worth careful reading, or rereading, by our members. We wish to thank these gentlemen for permission to reprint these contributions.

## SUSTAINING ASSOCIATES

We are pleased to list all of our Sustaining Associates in the Annual Program portion of this issue of the BULLETIN. This listing is current as of September 10, 1956. Our Sustaining Associates program is based on the following action of the 1954 Governing Board previously published in the June 1955 BULLETIN.

"Resolved: That (a) the Entomological Society of America provide for contributions from industrial companies or individuals to be known as Sustaining Associates. (b) The required fee is to be \$100.00 or more annually. (c) Sustaining Associates shall be listed in the Program of the Annual Meetings, in one issue each year of the ANNALS, and in one issue each year of the JOURNAL. Furthermore, all new Associates shall be listed in the BULLETIN, and a complete list of Associates shall accompany each full list of members that is published. (d) Sustaining Associates shall be privileged to submit appropriate short news items for the BULLETIN. (e) Each Associate is entitled to a gratis subscription to the BULLETIN and a copy of the Program of the Annual Meeting. (f) As a Sustaining Associate, a firm or individual will demonstrate to entomologists a vital interest in supporting the endless battle against the ravages of insects. (g) Sustaining Associates will also have the satisfaction of giving voluntary support in a real and substantial manner to the leading organization of the world whose efforts are directed to promoting the science of entomology in all its branches."

### BULLETIN of the ENTOMOLOGICAL SOCIETY OF AMERICA Published by ENTOMOLOGICAL SOCIETY OF AMERICA

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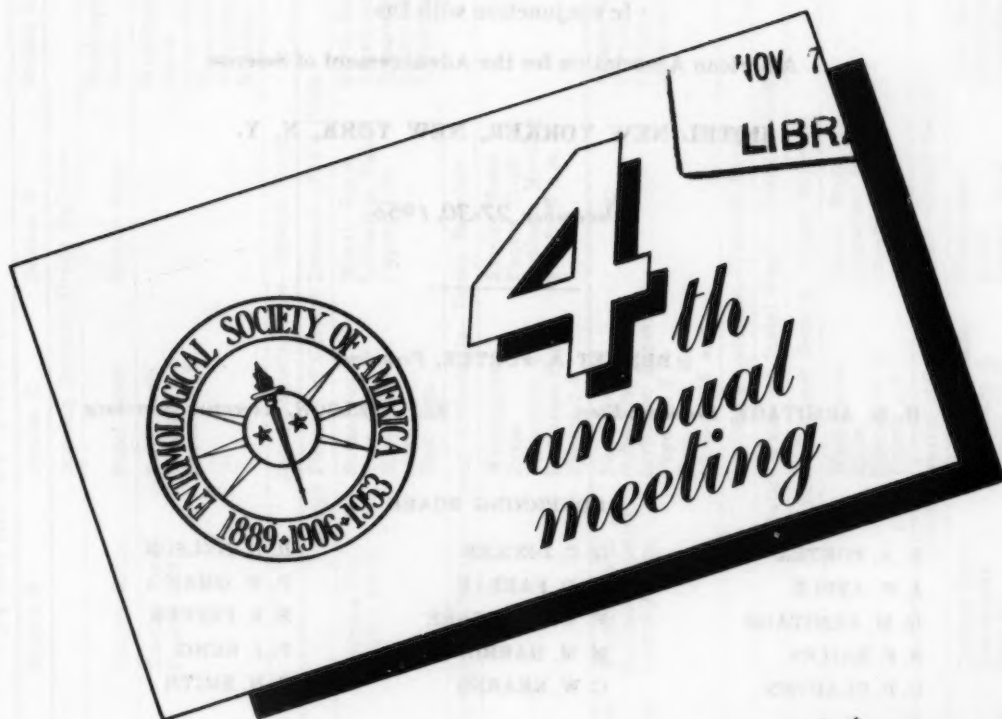
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HOTEL NEW YORKER  
NEW YORK CITY  
DECEMBER 27-30, 1956



ENTOMOLOGICAL  
SOCIETY  
OF AMERICA



BENNET A. PORTER  
President

**FOURTH ANNUAL MEETING**

**of the**

**ENTOMOLOGICAL SOCIETY OF AMERICA**

**In conjunction with the**

**American Association for the Advancement of Science**

**HOTEL NEW YORKER, NEW YORK, N. Y.**

*December 27-30, 1956*

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**H. M. ARMITAGE, *President-Elect***

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# SYNOPSIS OF PROGRAM

	Section A	Section B	Section C	Section D	Section E	Section F
	Opening Session—Grand Ballroom					
9:30-11:45 a.m.					Washington Room	North Ballroom
1:30-2:00 p.m.	Terrace Room	Empire Room	Panel Room	Mosaic Room		
Business Meetings						
2:00-5:00 p.m.	Terrace Room	Empire Room	Panel Room		Washington Room	North Ballroom
Presentation of Papers	Subsection a Symposium—Teaching Entomology	Papers 1-13	Subsection d Papers 1-12		Subsection b Symposium: The Nematode Situation	Papers 1-13
5:30-7:00 p.m.						
	Entomologist's Mixer—Mosaic Room					
8:30-11:30 a.m.						
	Motion Pictures of Current Interest—Panel Room					
8:30-11:30 a.m.	Empire Room	Terrace Room	Subsection c Tour of Rockefeller Institute Med. Res.	Mosaic Room	North Ballroom	Washington Room
Presentation of Papers	Papers 1-12	Papers 14-27		Invitation Paper Papers 1-10	Subsection a Symposium: Extension Entomology	Papers 14-27
1:30-5:00 p.m.						
	Invitational Program: Insect Attractants—Grand Ballroom					
7:30-10:30 p.m.	Panel Room	—	Washington Room	Empire Room	—	—
	Symposium: Museums and their Problems		Subsection c Invitation Paper Papers 1-5	Papers 11-15 Business Meeting		
8:30-11:15 a.m.	Washington Room	Empire Room	Panel Room	—	Mosaic Room	North Ballroom
Presentation of Papers and Business Meetings	Papers 13-21 Business Meeting 10:45-11:15	Business Meeting 9:00-9:30 a.m.	Subsection a Invitation Papers Papers 1-6 Sect. Bus. Meet. 10:45-11:15 a.m.		Papers 1-10 Business Meeting 10:45-11:15 a.m.	Papers 28-34 Business Meeting 10:45-11:15 a.m.
12:00-2:00 p.m.						
	President's Luncheon—Terrace Room					
2:30-3:30 p.m.						
	Invitation Paper on Insect Flight—Grand Ballroom					
3:30-5:00 p.m.						
	Final Business Session—Grand Ballroom					
7:30-9:30 p.m.	—	—	Washington Room	Mosaic Room	—	North Ballroom
			Subsection b Papers 1-6	Invitation Paper Papers 16-17		Papers 35-41
8:30-11:30 a.m.						
	Motion Pictures of Current Interest—Grand Ballroom					
8:30-12:00 m.	Mosaic Room	Terrace Room	North Ballroom	Washington Room	Panel Room	—
	Symposium: Insects in Nature	Symposium: Fate of Insecticides	Subsection d Papers 13-22	Papers 18-29	Subsection b Invitation Papers	

THURSDAY, DEC. 27

FRIDAY, DEC. 28

SATURDAY, DEC. 29

SUN. DEC. 30

## SECTION AND SUB-SECTION OFFICERS

### A. GENERAL ENTOMOLOGY

D. J. Borror, *Chairman*, Columbus, Ohio  
G. C. Steyskal, *Vice-Chairman*, Grosse Ile, Mich.  
L. A. Hetrick, *Secretary*, Gainesville, Fla.

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### B. PHYSIOLOGY AND TOXICOLOGY

Y. P. Sun, *Chairman*, Denver, Colo.  
Daniel Ludwig, *Vice-Chairman*, New York, N. Y.  
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### C. BIOLOGY

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#### Sub-Section b, Apiculture

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### E. CONTROL, EXTENSION AND REGULATORY ENTOMOLOGY

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G. D. Jones, *Vice-Chairman*, Raleigh, N. C.  
R. W. Sherman, *Secretary*, Washington, D. C.

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A. A. LaPlante, *Secretary*, Ithaca, N. Y.

#### Sub-Section b, Plant Pest Control and Quarantine

G. S. Langford, *Chairman*, College Park, Md.  
G. F. Callaghan, *Secretary*, Arlington, Va.

### F. CHEMICAL CONTROL INVESTIGATIONS

C. C. Alexander, *Chairman*, Bayonne, N. J.  
J. E. Fahey, *Vice-Chairman*, Vincennes, Ind.  
H. D. Tate, *Secretary*, Naugatuck, Conn.

## REGISTRATION

The Entomological Society of America registration fees are as follows: Non-members, \$7.50; Student members, \$1.00; other members, \$5.00; member's wives and invitation non-member speakers, complimentary.

Registration includes a copy of our program, admission to all Society meetings and admission to the complimentary Entomologists' Mixer 5:30-7:00 p.m. on Thursday, December 27.

In addition it is recommended that our registrants at the same time, register with the A.A.A.S. for \$1.00 additional. The A.A.A.S. registration entitles each

registrant to the following:

1. Posting in the Visible Directory of registrants at the Hotel Statler.
2. Admission to the Science Theater.
3. Admission to the A.A.A.S. Smoker on Saturday evening (8:30-11:00) December 29. Refreshments complimentary.
4. Repeated admission to A.A.A.S. exhibits.

Copies of the A.A.A.S. program, which includes the programs of all Societies at the meeting, will be available at \$2.00.

## MOTION PICTURES

Two half day sessions are scheduled during the Annual Meeting for showing of movies of current interest. Titles of movies are not included in the program, since it is anticipated that there will be available a number of which the Program Committee is not now aware. Members are invited to show motion pictures of entomological interest. Mr. Lyle Hagmann, College of Agriculture, Rutgers University, New Brunswick, New Jersey, who is responsible for projection arrangements, should be advised of pertinent details (title, running time, and if sound or color) about pictures that can be shown, and the films delivered to him by December 27. Because of the expense involved in hiring projectionists, motion pictures will not be shown at paper reading sessions.

Motion pictures thus far promised for the New

York meetings are "The Rival World," to be shown by courtesy of the Shell Chemical Corporation, and two films on nematodes, to be shown by courtesy of the Golden Nematode Control Project, Agricultural Research Service, U. S. Department of Agriculture.

## EXHIBITS

There is mezzanine space in the Hotel New Yorker for exhibits, and we hope many members will have material that will add to the interest of our meeting. Those having exhibits should contact Dr. Donald L. Collins, State Entomologist, New York State Museum and Science Service, Albany 1, New York, who is coordinating entomological exhibits for the Society and the AAAS. Dr. Collins should be advised of the nature of the exhibit, space requirements, and special facilities needed.

## DETAILED PROGRAM

### Thursday Morning, December 27

9:30-11:00 a.m.

*Opening Session*—Grand Ballroom. B. A. Porter, President and H. M. Armitage, President-Elect, Presiding

1. Invocation
2. Preliminary Announcements
3. Address by the President of the Society, "What Have We Learned from the Codling Moth?" B. A. Porter, Entomology Research Branch, Beltsville, Maryland

11:00-11:45 a.m.

*Preliminary Business Meeting*, Entomological Society of America, Grand Ballroom. President B. A. Porter, Presiding

1:30-2:00 p.m.

#### *Preliminary Sectional Business Meetings*

- Section A. General Entomology, Terrace Room.  
Chairman: D. J. Borror
- Section B. Physiology and Toxicology, Empire Room. Chairman: Y. P. Sun
- Section C. Biology, Panel Room  
Chairman: A. P. Arnason
- Section D. Medical and Veterinary Entomology, Mosaic Room. Chairman: C. B. Philip
- Section E. Control, Extension and Regulatory Entomology, Washington Room  
Chairman: F. A. Soraci
- Section F. Chemical Control Investigations, North Ballroom  
Chairman: C. C. Alexander

### Thursday Afternoon, December 27

2:00-5:00 p.m.

#### *Section A. General Entomology, Subsection a,*

*Teaching, Terrace Room*

Chairman: H. L. Sweetman  
Secretary: R. L. Blicke

#### *Symposium: Teaching Entomology*

##### *Attracting Entomology Students (pre-college)*

- a. Teaching of Biology to Pre-college Students. I. E. Wallen, Assistant Director, AAAS, Science Teaching Improvement Program, Washington, D. C.
- b. Influence of Museums and Entomological Clubs. Lucy W. Clausen, American Museum Natural History
- c. Techniques in Teaching. L. A. Hetrick, University of Florida, Gainesville

##### *Canadian Training Methods (college)*

- a. Comparison of Teaching Methods of Canada and the United States. A. S. West, Jr., Queens University
- b. Canadian Entomological Training. F. O. Morrison, McDonald College

##### *Training in the Plant Quarantine Branch, A.R.S.*

- a. In-service Training Programs in the Plant Quarantine Branch, Agricultural Research Service, Ira A. Lane, Plant Quarantine Branch

#### *Results of Entomological Training*

- a. Entomology in the Armed Services. K. L. Knight, U. S. Navy, Washington, D. C.
- b. Summary of Fitness of Entomological Trainees. S. B. Freeborn, University of California, Berkeley

2:00-5:00 p.m.

#### *Section B. Physiology and Toxicology, Empire Room*

Chairman: Y. P. Sun  
Secretary: A. S. Perry

#### *Submitted Papers:\**

- 2:00 1. A Physiological Interpretation of Metamorphosis Following Emergence of the Adult Insect. Morris Rockstein, New York University, New York, N. Y.
- 2:12 2. The Activity of Dehydrogenase Enzymes During the Metamorphosis of the Mealworm, *Tenebrio molitor*. Mary C. Barsa, Fordham University, New York, N. Y.
- 2:24 3. The Influence of Parental Age on the Growth of the Mealworm, *Tenebrio molitor*. Sister Kathleen Marie Tracy, Fordham University, New York, N. Y.
- 2:36 4. Studies on Allatectomy and Gonadectomy in Cockroaches (Blattidae-Orthoptera). Fred A. Lawson and Gregory B. Mulkern, Kansas State College, Manhattan.
- 2:48 5. Notes on the Head Glands of the Cockroach (Blattidae-Orthoptera). Gregory B. Mulkern and Fred A. Lawson, Kansas State College, Manhattan.
- 3:00 6. Observations on the Variations of Physiological Properties and Functions of the Organs of the American Cockroach, *Periplaneta americana*. R. L. Patton and Ruth A. Flint, Cornell University, Ithaca, N. Y.
- 3:12 7. The Electrophoretic Properties of the Blood of the American Cockroach, *Periplaneta americana*. A. N. Siakotos and R. L. Patton, Cornell University, Ithaca, N. Y.
- 3:24 8. Dephosphorylation of Nucleotides by Insect Flight Muscle. Bertram Sacktor and Donald G. Cochran, Army Chemical Center, Maryland.
- 3:36 Recess.
- 3:48 9. Studies on the Neuromuscular Apparatus of Cockroach Spiracles. James F. Case, Army Chemical Center, Maryland.
- 4:00 10. Attenuation of the Anaesthetic Effect of CO<sub>2</sub> on Cockroaches. James F. Case and R. W. Sturm, Army Chemical Center, Md.
- 4:12 11. The Influence of Alternating Temperatures on DDT Symptoms in the American Cockroach. L. K. Cutkomp and M. Taher, University of Minnesota, St. Paul.
- 4:24 12. Effects of Chilling of Pupae on Subsequent Emergence of Resistant and Non-Resistant House Flies. R. E. Siverly, Ball State Teachers' College, Muncie, Ind.

\* Abstracts of submitted papers, grouped by Section in which paper will be presented, are given following the detailed program. Numbers assigned to abstracts correspond to the numbers of the paper in the program.

## Thursday Afternoon

- 4:36 13. Some Effects of Temperature on Adult House Flies Treated with DDT. Roy J. Barker, Entomology Research Branch, Beltsville, Md.

2:00-5:00 p.m.

### Section C. Biology, Subsection d, Ecology and Bionomics, Panel Room

Chairman: P. O. Ritcher  
Secretary: J. T. Medler

#### Submitted Papers:

- 2:00 1. Oviposition Response of the Imago of the Corn Earworm *Heliothis zea* (Boddie) to Various Wavelengths of Light. Philip S. Callahan, Louisiana Agricultural Experiment Station, Baton Rouge.
- 2:12 2. Reproductive Behavior and Oviposition of the Corn Earworm, *Heliothis zea* (Boddie). Philip S. Callahan, Louisiana Agricultural Experiment Station, Baton Rouge.
- 2:24 3. Western Bean Cutworm as a Pest of Corn. J. R. Douglass, K. E. Gibson, W. E. Peay, and J. W. Ingram, Entomology Research Branch, Twin Falls, Idaho.
- 2:36 4. *Matsucoccus* Bark Scale. Albert Hartzell. Boyce Thompson Institute for Plant Research, Yonkers, N. Y.
- 2:48 5. Some Observations on the Biology of Two Species of Ground Pearls. William T. Spink, North Carolina State College, Raleigh.
- 3:00 6. Leafhoppers from Turf in Gainesville, Florida. Frank W. Mead, State Plant Board of Florida, Gainesville.
- 3:12 7. Relationship of *Lygus* Bug Populations to Blackeye Bean Necrosis. Woodrow W. Middlekauff, University of California, Berkeley.
- 3:24 Recess
- 3:36 8. The Biology and Ecology of the Jewelweed Flower-Bud Midge *Schizomyia impatientis* (O.S.). Cleo Mary Hummel, Westminster College, New Wilmington, Pa.
- 3:48 9. Ecological Observations on the Vespertine Bee *Lasioglossum* (*Sphecodogastra*) *aberrans*, a Pollinator of Evening Primroses. Paul D. Hurd, Jr., University of California, Berkeley.
- 4:00 10. Competition Among Some Matinal Bees which Collect Pollen from *Oenothera*. E. G. Linsley, University of California, Berkeley
- 4:12 11. Comparative Study of the Bionomics of Several Species of Blow Flies and Flesh Flies. Adel Kamal and M. T. James, Washington State College, Pullman.
- 4:24 12. In Vitro Humidity Requirements of the Black Carpenter Ant. John B. Simeone, State University of New York, Syracuse.

2:00-5:00 p.m.

### Section E. Control, Extension and Regulatory Entomology, Subsection b, Plant Pest Control and Quarantine, Washington Room

Chairman: G. S. Langford  
Secretary: G. F. Callaghan

#### Symposium: The Nematode Situation

- a. An Evaluation of the Nematode Problem. Albert L. Taylor, Horticultural Crops Research Branch, Beltsville, Md.
- b. Status of the Golden Nematode. Emory D. Burgess, Plant Pest Control Branch, Washington, D. C.
- c. The Soybean Nematode in North Carolina. J. N. Sasser, North Carolina State College, Raleigh.
- d. The Burrowing Nematode Situation in Florida. Wray Birchfield, State Plant Board of Florida, Gainesville, Fla.
- e. Summarization. W. Lee Popham, Crops Regulatory Programs, Washington, D. C.

2:00-5:00 p.m.

### Section F. Chemical Control Investigations, North Ballroom

Chairman: C. C. Alexander  
Secretary: H. D. Tate

#### Submitted Papers:

- 2:00 1. Field Assessment of Airplane Sprays with Radioisotopes. Dale W. Jenkins, Biological Warfare Laboratories, Fort Detrick, Frederick, Md.
- 2:12 2. Biological Studies of Boll Weevils Differing in Susceptibility to the Chlorinated Hydrocarbon Insecticides. R. V. Bielarski, J. S. Roussel and D. F. Clower, Louisiana State Experiment Station, Baton Rouge.
- 2:24 3. The Status and Control of Chlorinated Hydrocarbon Resistant Boll Weevil in Louisiana. J. S. Roussel and D. F. Clower, Louisiana State Experiment Station, Baton Rouge.
- 2:36 4. Control of *Hypera meles* in Crimson Clover. H. H. Tippins and C. M. Beckham, Georgia Experiment Station, Experiment.
- 2:48 5. The Effects of Some Insecticidal Materials on the Larval Population Levels of the Alfalfa Weevil, *Hypera postica* (Gyll.) in Southern Pennsylvania. Norris D. Blackburn, Pennsylvania State University, University Park.
- 3:00 6. Effects of Granular Dieldrin and Heptachlor on Adult Weevil Populations in Red Clover. H. L. Hansen and C. K. Dorsey, West Virginia University, Morgantown.
- 3:12 7. Status and Control of the Spotted Alfalfa Aphid in Arizona from 1954-1956. D. M. Tuttle, V. D. Roth and L. A. Carruth, University of Arizona, Tucson.
- 3:24 Recess
- 3:36 8. Effects of Sun, Wind and Rain on DDT Spray Residues on Alfalfa. Ellis W. Hudleston and George G. Gyrisco, Cornell University, Ithaca, N. Y.



## Thursday Afternoon and Evening, Friday Forenoon

- 3:48 9. Factors in Greenbug Control in the High Plains Area. Donald Ashdown, Texas Technological College, Lubbock.
- 4:00 10. Evaluation of Thrips Attack on Irrigated Corn in Mexico. G. B. Riley, Columbus, Ohio.
- 4:12 11. Field Experiments with Insecticides to Prevent Lettuce-Yellows Infection from Viruliferous Six-spotted Leafhoppers, *Macrostelus fascifrons* (Stal.) R. G. Strong and W. A. Rawlins, Cornell University, Ithaca, N. Y.
- 4:24 12. Time of Insecticide Applications in European Corn Borer Control. H. C. Cox and T. A. Brindley, Entomology Research Branch and Iowa State College, Ames.
- 4:36 13. European Corn Borer Control in Relation to Malathion Residues. H. C. Cox, J. E. Fahey and T. A. Brindley, Entomology Research Branch and Iowa State College, Ames.

### Thursday Evening, December 27

5:30-7:00 p.m.

Entomologists' Mixer, Mosaic Room

### Friday Morning, December 28

8:30-11:30 a.m.

#### Section A. General Entomology, Empire Room

Chairman: D. J. Borror

Secretary: L. A. Hetrick

#### Submitted Papers:

- 8:30 1. An Account of a Revisit to the Type Locality of Two Mexican Dragonflies, *Aeshna manni* Williamson and to the Original Locality of the Allotype of *Erpetogomphus natriz* Williamson, Los Parres, Baja California, Mexico. Charles F. Harbison, San Diego Society of Natural History, San Diego, California.
- 8:42 2. Extension of the Reported Range of a Damselfly, *Enallagma eiseni* Calvert Northward about Two Hundred Air Miles to the Vicinity of Los Angeles Bay, Baja California, Mexico. Charles F. Harbison, San Diego Society of Natural History, San Diego, California.
- 8:54 3. The Classification and Nomenclature of Calopterygine Dragonflies (Odonata: Calopterygoidea). B. Elwood Montgomery, Purdue University, Lafayette, Indiana.
- 9:06 4. The Nymph of the Mayfly *Tortopus*. D. C. Scott, Allan Hirsch, and Lewis Berner, University of Georgia, U. S. Public Health Service, and the University of Florida.
- 9:18 5. The Origin of the Families of the Thysanoptera. Lewis J. Stannard, Jr., Illinois Natural History Survey, Urbana.

- 9:30 6. The Adaptive and Phylogenetic Significance of Uninterrupted Wing Venation in Coleoptera, with Special Reference to the Genus *Atractocerus*. Richard B. Selander, State Natural History Survey, Urbana, Illinois.

9:42 Recess

- 9:54 7. Character Convergence in Two Sympatric Populations of *Lytta* (Coleoptera). Richard B. Selander, State Natural History Survey, Urbana, Ill.

- 10:06 8. Some Problems of the External Anatomy of Beetle Larvae. Jerome G. Rozen, Jr., Entomology Research Branch, Washington, D. C.

- 10:18 9. The Distribution and Origin of the North American Pygmy Grasshopper (Tetrigidae) Fauna. Harold J. Grant, Jr., and James A. G. Rehn, Academy of Natural Sciences of Philadelphia, Pa.

- 10:30 10. The Distribution of the Tetrigid Subfamily Batrachideinae. Harold J. Grant, Jr., Academy of Natural Sciences of Philadelphia, Pa.

- 10:42 11. A New *Actaletes* (Collembola) with Marked Sexual Dimorphism. Peter F. Bellingier, Yale University, New Haven, Conn.

- 10:54 12. The Relative Usefulness of Anatomical and Physiological Characters for Recognition of Species and Subspecies of *Euschistus* (Hemiptera: Pentatomidae). Reece I. Sailer, Entomology Research Branch, Washington, D. C.

8:30-11:30 a.m.

#### Section B. Physiology and Toxicology, Terrace Room

Chairman: Y. P. Sun

Secretary: A. S. Perry

#### Submitted Papers:

- 8:30 14. Some Chemical and Biological Experiments with Thiodan. Donald A. Lindquist and Paul A. Dahm, Iowa State College, Ames.
- 8:42 15. The Relationship between Structure and Insecticidal Activity in Organotin Compounds. Murra, S. Blum and John J. Pratt, Jr., Quartermaster Research and Development Command, Natick, Mass.
- 8:54 16. The Relationship between Structure and Synergistic Activity of Compounds Evaluated as DDT Synergists. Murry S. Blum and John J. Pratt, Jr., Quartermaster Research and Development Command, Natick, Mass.
- 9:06 17. The Deleterious Effects of DDT on the Oviposition and the Egg Fertility of the Confused Flour Beetle. M. Taher and L. K. Cutkomp, University of Minnesota, St. Paul.



## Friday Forenoon

- 9:18 18. Factors Affecting the Feeding Activity of DDT-Resistant Potato Flea Beetles. James B. Kring, The Connecticut Agricultural Experiment Station, New Haven.
- 9:30 19. The Physiological Basis of Host Specificity in the Mexican Bean Beetle, *Epilachna varivestis* Muls. Paul C. Lippold and G. S. Fraenkel, University of Illinois, Urbana.
- 9:42 20. Comparative Study of the Digestive Enzymes of Several Species of Blow Flies and Flesh Flies. Adel Kamal, Washington State College, Pullman.
- 9:54 21. The Role of Sucrose in the Survival of Adult House Flies. Bernard Greenberg, University of Illinois, Chicago.
- 10:06 Recess
- 10:18 22. The Effects of Organic Solvents on Colorimetric Tests for Piperonyl Butoxide and the Fate of C<sup>14</sup>-Labeled Piperonyl Butoxide in the Madeira Cockroach, *Leucophaea maderae* (F.). Claude H. Schmidt and Paul A. Dahm, Iowa State College, Ames.
- 10:30 23. The Fate of P<sup>32</sup>-Labeled Dow ET-57 in the Bovine Body. William E. Robbins, Theodore L. Hopkins and Gaines W. Eddy, Entomology Research Branch, Corvallis, Oregon.
- 10:42 24. Effects of Gamma Radiation on Population Growth in Collembola. S. I. Auerbach, Oak Ridge National Laboratory, Tennessee, and Manfred Engelmann, University of Michigan, Ann Arbor.
- 10:54 25. Some Effects of Gamma Radiation on the Reproduction of *Trogoderma sternale* (Coleoptera: Dermestidae). H. F. Howden, University of Tennessee, Knoxville, and S. I. Auerbach, Oak Ridge National Laboratory, Tennessee.
- 11:06 26. Sterilization of the White-Pine Weevil with Gamma Radiation. H. A. Jaynes and P. A. Godwin, Northeastern Forest Experiment Station, New Haven, Conn.
- 11:18 27. Inheritance of Ability to Synthesize DDT-Dehydrochlorinase and its Relationship to DDT-Resistance to the House Fly. J. Byron Lovell and Clyde W. Kearns, University of Illinois, Urbana.

8:30-12:00 m.

### Section C. Biology, Subsection c, Relations of Insects to Plant Diseases

Chairman: F. F. Smith  
Secretary: R. C. Dickson

Tour of Rockefeller Institute for Medical Research. Detailed information available at registration desk, or consult Floyd Smith.

8:30-11:30 a.m.

### Section D. Medical and Veterinary Entomology, Mosale Room

Chairman: C. B. Philip  
Secretary: W. D. Reed

### Invitation Paper:

The Status of Yellow Fever in the Americas.  
Fred L. Soper, Pan-American Sanitary Bureau, Washington, D. C.

### Submitted Papers:

- 9:12 1. The Status of Malaria Control in Thailand. Melvin E. Griffith, Public Health Service, USOM/Thailand, International Cooperation Administration, and Ernestine B. Thurman, Public Health Service, Bethesda, Maryland.
- 9:24 2. Influence of Surface Color on Mosquito Landing Rates. I. H. Gilbert and H. K. Gouck, Entomology Research Branch, Orlando, Fla.
- 9:36 3. Seasonal Biting Rates of Mosquitoes in a Central Ohio Woods. Frank W. Mead, State Plant Board of Florida, Gainesville.
- 9:48 4. Notes on Number of Branches of #2 (antipalmate) Hair in Anophelines and Their Variations through Selective Breeding in *Anopheles freeborni*. Robert W. Burgess, National Institutes of Health, Columbia, S. C.
- 10:00 Recess
- 10:12 5. *Vorticella* on larvae of *Aedes canadensis* and *Aedes stimulans*. Carl Venard and Elden G. Burcham, Ohio State University, Columbus.
- 10:24 6. Survival of Enteric Pathogens in Larvae and Pupae of the House Fly. Bernard Greenberg, University of Illinois, Chicago.
- 10:36 7. A Report on the Colonization of *Culicoides variipennis* (Coquillett), the Possible Vector of Bluetongue of Sheep in the Southwest. R. H. Jones, Entomology Research Branch, Kerrville, Texas.
- 10:48 8. Sampling Methods used in Estimating Larval Populations of Salt-Marsh Tabanids. W. Wall, Suffolk County Mosquito Control Commission and H. Jamnback, New York State Museum and Science Service, Albany.
- 11:00 9. Geographical Distribution and Hosts of *Ixodes texanus* Banks (Acarina, Ixodidae). Richard F. Darsie, Jr., University of Delaware, Newark.
- 11:12 10. Worldwide Compilations of Arthropods of Medical Importance. B. V. Travis, Cornell University, Ithaca, N. W.

8:30-11:30 a.m.

### Section E. Control, Extension and Regulatory Entomology, Subsection a, Extension, North Ballroom.

Chairman: E. H. Wheeler  
Secretary: A. A. LaPlante

### Symposium:

Responsibilities of the Extension Entomologist

### Panel Discussions

- a. The Impact of Public Law 518 on the Responsibilities of the Extension Entomologist

## Friday Forenoon, Afternoon and Evening

- b. The Responsibilities of Extension to Research and Teaching.
- c. The Responsibilities of Extension Entomologists in Relation to Program Development.

8:30-11:30 a.m.

*Section F. Chemical Control Investigations, Washington Room*

Chairman: C. C. Alexander  
Secretary: H. D. Tate

### *Submitted Papers:*

- 8:30 14. Present Status of the Control of the Fall Armyworm in Corn in Colombia. Robert F. Ruppel, Rockefeller Foundation, Colombia, South America.
- 8:42 15. Report on the National Corn Earworm Experiment for 1956. W. G. Eden, Alabama Agricultural Experiment Station, Auburn.
- 8:54 16. The Bionomics and Control of the Maggot Complex Associated with Spinach. Gordon E. Guyer, Michigan State College, East Lansing.
- 9:06 17. Control of the Carrot Rust Fly, *Psila rosae*, in New York. Emmett Harris, Jr. and W. A. Rawlins, Cornell University, Ithaca, N. Y.
- 9:18 18. Effects of Insecticide Seed Treatments on Wireworm Activities. W. H. Long and J. H. Lilly, Iowa State College, Ames.
- 9:30 19. Rearing of the Plum Curculio and its Use in Biological and Toxicological Studies. E. H. Smith, New York State Agricultural Experiment Station, Geneva.
- 9:42 20. Plum Curculio Control with Soil Insecticides. Oliver I. Snapp, Entomology Research Branch, Fort Valley, Georgia.
- 9:54 Recess
- 10:06 21. Experiences with Ryania for Control of Codling Moth and Other Apple Pests. D. W. Hamilton and M. L. Cleveland, Entomology Research Branch, Vincennes, Indiana.
- 10:18 22. Relationship of Spray Date to Residues of Chlorinated Hydrocarbon Pesticides in Peaches. Jack E. Fahey, D. W. Hamilton and H. W. Rusk, Entomology Research Branch, Vincennes, Ind.
- 10:30 23. Effect of BHC Emulsion Sprays on the Insect Invasion of Hurricane-Felled Pine Logs and the Grade-Yield of the Resulting Lumber. W. B. Becker and H. G. Abbott, University of Massachusetts, Amherst.
- 10:42 24. A Study of a Flow-Meter for Determining Rates of Flow in Spray Machines. Philip Garman, Connecticut Agricultural Experiment Station, New Haven.
- 10:54 25. Further Study of Ground Fauna in Connection with Fruit Tree Sprays. Philip Garman and Henry Hurlburt, Connecticut Agricultural Experiment Station, New Haven.

- 11:06 26. Comparison of Responses of Various Stages of Five Species of Spider Mites to Four Acaricides. Mohamed Ramadan Abo El Ghar and H. Bruce Boudreaux, Louisiana State University, Baton Rouge.

- 11:28 27. The Effect of Soil Insecticides on Plants and the Resulting Effect on Mite Nutrition. J. G. Rodriguez, University of Kentucky, Lexington.

8:30-11:30 a.m.

Motion Pictures ..... Panel Room

## Friday Afternoon, December 28

1:30-5:00 pm.

*Invitational Program, Grand Ballroom*

Louis G. Roth, Presiding

### *Insect Attractants*

- a. The physiological basis for insect attraction. V. G. Dethier, Johns Hopkins University, Baltimore, Md.
- b. Host selection by phytophagous insects. A. J. Thorsteinson, University of Manitoba, Winnipeg, Canada.
- c. Host finding by blood-sucking arthropods. E. R. Willis, Quartermaster Research Laboratories, Natick, Mass.
- d. Studies on the sex attractant of the American cockroach. D. R. A. Wharton, Quartermaster Research Laboratories, Natick, Mass.

## Friday Evening, December 28

7:30-10:30 p.m.

*Section A. General Entomology, Panel Room*

Chairman: D. J. Borror  
Secretary: L. A. Hetrick

### *Symposium: Museums and Their Problems*

- a. General statements of museum objectives. A. B. Grobman, Florida State Museum, Gainesville.
- b. Responsibilities of the curator of insects. T. H. Hubbell, University of Michigan, Ann Arbor.
- c. Responsibilities of the Department of Education. J. R. Saunders, American Museum of Natural History, New York, N. Y.
- d. Museum publication policies. John S. Lea, U. S. National Museum, Washington, D. C.
- e. Museum financial and personnel problems. A. E. Parr, American Museum of Natural History, New York, N. Y.
- f. The future of museums. A. S. Romer, Museum of Comparative Zoology, Cambridge, Mass.

7:30-10:30 p.m.

*Section C. Biology, Subsection c, Relations of Insects to Plant Diseases, Washington Room*

Chairman: F. F. Smith  
Secretary: R. C. Dickson

## Friday Evening, Saturday Forenoon

### Invitation Paper:

Insect Hosts of Plant Viruses. Karl Maramorosch, The Rockefeller Institute for Medical Research, New York, N. Y.

Open Discussion of Preceding Paper; discussion leader to be announced.

### Submitted Papers:

- 8:12 1. Vector Specificity of Three Aphid-Borne Viruses. K. G. Swenson, Oregon State College, Corvallis.
- 8:24 2. Some Studies on the Aphid Transmission of Brassica Viruses 1 and 2. R. B. Chalfant and R. K. Chapman, University of Wisconsin, Madison.
- 8:36 3. Host Range and Transmission of Pea Enation Mosaic Virus. F. L. McEwen, W. T. Schroeder and A. C. Davis, New York State Agricultural Experiment Station, Geneva, N. Y.
- 8:48 4. Control of Pea Enation Mosaic in Peas with Insecticides. A. C. Davis, W. T. Schroeder and F. L. McEwen, New York State Agricultural Experiment Station, Geneva, N. Y.
- 9:00 5. Attempts to Control Some Vegetable Viruses with Insecticides. R. K. Chapman and R. B. Chalfant, University of Wisconsin, Madison, Wis.

7:30-8:30 p.m.

### Section D. Medical and Veterinary Entomology, Empire Room

Chairman: C. B. Philip  
Secretary: W. D. Reed

### Submitted Papers:

- 7:30 11. Development of Attractants for the Screw-worm Fly. M. Brandstein, A. H. Baumhover, and W. D. New, Entomology Research Branch, Beltsville, Md.
- 7:42 12. Colonization of a Florida Strain of the Screw-worm Fly. A. H. Baumhover and W. D. New, Entomology Research Branch, Beltsville, Md.
- 7:54 13. Further Studies on Resistance of Human Body Lice to Insecticides. M. M. Cole, M. D. Couch, G. S. Burden, and I. H. Gilbert, Entomology Research Branch, Beltsville, Md.
- 8:06 14. Inheritance of Resistance to Lindane in the German Cockroach. J. G. Barker, J. M. Grayson and M. Levitan, Virginia Polytechnic Institute, Blacksburg, Va.
- 8:18 15. Residual Effectiveness of Different Insecticide Formulations for Control of Resistant and Non-Resistant German Cockroaches. F. E. Jarvis and J. M. Grayson, Virginia Polytechnic Institute, Blacksburg, Va.

8:45 p.m.

### Section D. Medical and Veterinary Entomology, Empire Room Final Business Meeting

## Saturday Morning, December 29

8:30-10:30 a.m.

### Section A. General Entomology, Washington Room Chairman: D. J. Borror Secretary: L. A. Hetrick

### Submitted Papers:

- 8:30 13. Differentiation of Second and Third Stage Larvae of California *Culex*. R. M. Bohart and R. K. Washino, University of California, Davis.
- 8:42 14. A New Era in Ideas of Systematic Relationships of World Tabanidae Inaugurated by Mackerras, and the Impact on Nomenclature of Horseflies of the Western Hemisphere. C. B. Philip, Rocky Mountain Laboratory, Hamilton, Montana.
- 8:54 15. A Comparison of the Male Reproductive Systems in Two Doryline Ants. James Forbes, Fordham University, New York, N. Y.
- 9:06 16. Colleterial Glands of *Diploptera dytiscoides*. Barbara A. Stay, U. S. Army Quartermaster Research and Development Center, Natick, Mass.
- 9:18 17. The Nature of the "Alarm Reaction" of Mosquito Larvae and Pupae. G. Fraenkel, University of Illinois, Urbana.
- 9:30 18. Serial Morphology as a Technique for Determination of Reproductive Patterns in Lepidoptera. P. S. Callahan, Louisiana Agricultural Experiment Station, Baton Rouge.
- 9:42 Recess
- 9:54 19. Evidence for a Virus Affecting Morphology in Spider Mites. H. Bruce Boudreaux, Louisiana State University, Baton Rouge.
- 10:06 20. Phytophagous Mites of Mexico. Robert E. Beer, Department of Entomology, University of Kansas, Manhattan.
- 10:18 21. Refinements in the Use of Offset Printing for the Preparation of Entomological Data Labels. Howard V. Weems, Jr., State Plant Board of Florida, Gainesville.

8:30-10:30 a.m.

### Section C. Biology, Subsection a, Biological Control, Panel Room

Chairman: D. W. Clancy  
Secretary: M. H. Brunson

### Invitation Papers:

The Role of Insect Pathology in Biological Control. C. G. Thompson, Entomology Research Branch, Beltsville, Md.

Biological Control of Forest Insects. P. B. Dowden, Northeastern Forest Experiment Station, New Haven, Conn.

### Submitted Papers:

- 9:24 1. Effect of the Protozan, *Perezia pyraustae* Paillet, on the European Corn Borer. H. L. Zimmack, Iowa State College, and T. A. Brindley, Entomology Research Branch, Ames, Iowa.

## Saturday Forenoon

9:36 2. Tests with the Fungus *Beauveria* sp. for the Control of the European Corn Borer. George T. York, Entomology Research Branch, Beltsville, Md.

9:48 3. Susceptibility of European chafer and Japanese Beetle Larvae to Different Strains of Milky Disease Organisms. H. Tashiro, Entomology Research Branch, Beltsville, Md.

10:00 4. Laboratory and Field Tests with Granulosis Disease of Red-Banded Leaf Roller. E. H. Glass, New York State Agricultural Experiment Station, Geneva, N. Y.

10:12 5. The Reproductive Rate of Entomophagous Insects in Relation to that of Their Hosts. C. P. Clausen, University of California, Riverside.

10:24 6. Biological Characteristics of Taxonomic Groupings in the Ichneumonidae. Henry Townes, University of Michigan, Ann Arbor.

8:30-10:30 a.m.

*Section E. Control, Extension and Regulatory Entomology, Mosaic Room*

Chairman: F. A. Soraci

Secretary: R. W. Sherman

*Submitted Papers:*

8:30 1. Insect Problems in the Marketing of Agricultural Products. Randall Latta, Agricultural Marketing Service, Beltsville, Md.

8:42 2. Weight Loss in Stored Corn and Beans Caused by Insect Feeding. E. J. Gerberg and S. L. Goldheim, Insect Control and Research, Inc., Baltimore, Md.

8:54 3. Methods to Prevent Insect Infestation in Whole Black Pepper During Storage and Shipment from the Orient. Ralph T. White, Stored Products Insects Section, Agricultural Marketing Service, Beltsville, Md.

9:06 4. The Practicability of Flotation as a Means of Detecting Internal Insect Infestation in Wheat. Gailen D. White, Stored Grain Insects Laboratory, Manhattan, Kansas.

9:18 5. Determining Insect Populations in Empty Grain Bins by the Use of P<sup>32</sup>. David Walker, Robert Harwood, and Kermit Groves, State College of Washington, Pullman.

9:30 6. The Development of Sequential Sampling for Forest Tent Caterpillar Survey in New York. D. P. Connola, W. E. Waters and W. E. Smith, State Science Service, Albany, N. Y.

9:42 7. A System for Coding Insects and Hosts for Machine Keysort. H. A. Denmark and H. V. Weems, Jr., State Plant Board, Gainesville, Fla., and Carlis A. Taylor, University of Florida, Gainesville.

9:54 8. Mass Production Techniques for Embedding Fruit Fly in Plastic. G. W. Dekle, State Plant Board, Gainesville, Fla.

10:06 9. Quality Control Techniques Applied to Measure the Effectiveness of Organic Insecticides. W. C. Davis, C. Lincoln and D. Valinsky. University of Arkansas, Fayetteville.

10:18 10. A Review of the Uses of Ionizing Radiation in the Disinfestation of Foods. J. D. Hilchey, Quartermaster Research and Development Center, Natick, Mass.

8:30-10:30 a.m.

*Section F. Chemical Control Investigations, North Ballroom*

Chairman: C. C. Alexander

Secretary: H. D. Tate

*Submitted Papers:*

8:30 28. The Influence of Viscosity on the Ovicidal Efficiency of "Superior" Type Spray Oils Against Winter Eggs of the European Red Mite. P. J. Chapman, S. E. Lienk and W. Shea, New York State Agricultural Experiment Station, Geneva.

8:42 29. Variation in Toxicity of Malathion in Dust Mixtures to Two-Spotted Spider Mites. E. A. Taylor and F. F. Smith, Entomology Research Branch, Beltsville, Md. and W. D. McClellan, Horticultural Crops Research Branch, Beltsville, Md.

8:54 30. Granular Insecticide Formulations for Soil Insect Control. R. A. Didriksen and J. H. Lilly, Iowa State College, Ames.

9:06 31. Ten Years of Testing New Organic Insecticides as Soil Poisons Against the Eastern Subterranean Termite, *Reticulitermes flavipes* (Kollar). L. A. Hetrick, University of Florida, Gainesville.

9:18 Recess

9:30 32. Laboratory Techniques for Evaluating the Effect of Soil Insecticides on the Subterranean Termite. J. V. Osmun, Purdue University, Lafayette, Ind.

9:42 33. Insecticidal Residues in Soils. E. P. Lichtenstein, University of Wisconsin, Madison.

9:54 34. Persistence of Insecticides in Soils under Controlled Conditions. E. P. Lichtenstein, University of Wisconsin, Madison.

9:00-9:30 a.m.

*Section B. Physiology and Toxicology, Empire Room*

Chairman: Y. P. Sun

*Final Business Meeting*

10:45-11:15 a.m.

*Final Business Meetings*

*Section A. General Entomology, Washington Room*

Chairman: D. J. Borror

*Section C. Biology, Panel Room*

Chairman: A. P. Arnason



## Saturday Forenoon, Afternoon and Evening

### Section E. Control, Extension and Regulatory Entomology, Mosaic Room

Chairman: F. A. Soraci

### Section F. Chemical Control Investigations, North Ballroom

Chairman: C. C. Alexander

## Saturday Afternoon, December 29

12:00-2:00 p.m.

### Entomological Society of America, President's Luncheon, Terrace Room

2:30-3:30 p.m.

### Invitational Program, Grand Ballroom

President B. A. Porter, Presiding

Some Aspects of Insect Flight. B. Hocking, University of Alberta, Edmonton, Alberta, Canada.

3:30-5:00 p.m.

Final Business Meeting, Entomological Society of America, Grand Ballroom. President B. A. Porter, Presiding.

## Saturday Evening, December 29

7:30-9:30 p.m.

### Section C. Biology, Subsection b, Apiculture, Washington Room

Chairman: E. J. Dyce

Secretary: E. J. Anderson

### Submitted Papers:

- 7:30 1. Morphological Changes During the Life of the Honey Bee. Mykola H. Haydak, University of Minnesota, St. Paul.
- 7:42 2. Automictic Parthenogenesis in the Honey Bee (*Apis mellifera* L.) Kenneth W. Tucker, University of Minnesota, St. Paul.
- 7:54 3. An Ecological Approach to Alsike Clover Pollination by Honey Bees. Kenneth W. Tucker, University of Minnesota, St. Paul.
- 8:06 4. Honey Bees, Bumble Bees and Competing Flowers as Factors in Pollination of Red Clover in Minnesota. Allan G. Peterson, University of Minnesota, St. Paul.
- 8:18 5. An Electrical Machine for Periodical Collection of Pollen Collected by The Honey Bee. Salah El-din Rashad, Kansas State College, Manhattan.
- 8:30 6. The Effects of Certain Fungicides on Honey Bees. E. J. Anderson, Pennsylvania State University, University Park, and F. R. Shaw, University of Massachusetts, Amherst.

7:30-9:30 p.m.

### Section D. Medical and Veterinary Entomology, Mosaic Room

Chairman: C. B. Philip

Secretary: W. D. Reed

### Invitation Paper:

Perspectives in Insect Endocrinology and Tissue Culture. Howard A. Schneiderman, Cornell University, Ithaca, N. Y.

Open Discussion of Preceding Paper; William Trager, Discussion Leader

### Submitted Papers:

- 8:12 16. Variations in the Ratio of the width to the Length of the Second Abdominal Sternum of Several House Fly Strains, and the Relation of the Ratio to DDT-Resistance. Frank O. Morrison, MacDonald College, Quebec, Canada.
- 8:24 17. Experimental Control of Salt-Marsh Tabanid Larvae, Using Granular Formulations of Insecticide. H. Jamnback, New York State Museum and Science Service, Albany, and W. Wall, Suffolk County Mosquito Control Commission, New York.

7:30-9:30 p.m.

### Section F. Chemical Control Investigations, North Ballroom

Chairman: C. C. Alexander

Secretary: H. D. Tate

### Submitted Papers:

- 7:30 35. Methyl Bromide Fumigation of Fruit Under Plastic Tarpaulins and at Cold Temperatures. Henry H. Richardson and H. Roth, Entomology Research Branch, Hoboken, N. J.
- 7:42 36. Laboratory Studies of Sulfuryl Fluoride as an Insecticidal Fumigant. E. E. Kenaga, The Dow Chemical Company, Midland, Mich.
- 7:54 37. Laboratory Tests with Malathion as a Wheat Protectant. K. S. Gore and H. H. Schwardt, Cornell University, Ithaca, New York.
- 8:06 38. The Use of Residual Sprays for Controlling Stored Grain Insects in Washington. David Walker, State College of Washington, Pullman.
- 8:18 39. Concentrations of DDVP Insecticidal for the Cigarette Beetle. Ralph L. Tracy, Joseph Gentile and J. M. Wenneis, Norda Essential Oil and Chemical Co., Inc., New York, N. Y.
- 8:30 40. Research on Insecticidal Control of Philippine Crop Pests. John G. Matthyse, Cornell University, Ithaca, N. Y.
- 8:42 41. The Systemic Action of Lindane in Alfalfa upon the Meadow Spittlebug. C. S. Koehler and George G. Gyrisco, Cornell University, Ithaca, N. Y.



## Sunday Forenoon

### Sunday Morning, December 30

8:30-12:00 m.

#### Section A. General Entomology. Joint Session with Society of Systematic Zoology, Mosaic Room

Chairman: D. J. Borror

Secretary: L. A. Hetrick

#### Symposium:

The Role of Insects in Nature.

- a. Physiology and Its Contributions. K. D. Roeder, Tufts University, Medford, Mass.
- b. Systematics and Evolution. H. H. Ross, University of Illinois, Urbana.
- c. Insect Contributions to Genetics. Th. Dobzhansky, Columbia University, New York.
- d. The Numbers of Insects. Curtis Sabrosky, Entomology Research Branch, Washington, D. C.
- e. The Value of Insects. D. M. DeLong, Ohio State University, Columbus.

8:30-12:00 m.

#### Section B. Physiology and Toxicology, Terrace Room

Chairman: Y. P. Sun

Secretary: A. S. Perry

#### Symposium:

The Fate of Insecticides in Plants and Animals.

- a. Comparative Metabolic Fates of DDT. H. H. Morefield, Boyce Thompson Institute, Yonkers, N. Y.
- b. The Rate of Storage and Excretion of DDT in the Rat. W. J. Hayes and W. F. Durham, U. S. Public Health Service, Savannah, Ga.
- c. Metabolism of Organophosphorus Insecticides by Certain Microorganisms. Mostafa Kamal Ahmed and John E. Casida, University of Wisconsin, Madison.
- d. Intermediary Metabolic Studies with DDT in Rats, Evaluation of Residue Toxins of Systox<sup>®</sup> and Thimet<sup>®</sup> in Alfalfa, and the Effects of Feeding Systox<sup>®</sup> Residue Toxins to Cows and Poultry. Paul A. Dahm, Iowa State College, Ames.

8:30-10:45 a.m.

#### Section C. Biology, Subsection d, Ecology and Bionomics, North Ballroom

Chairman: P. O. Ritcher

Secretary: J. T. Medler

#### Submitted Papers:

- 8:30 13. An Ecological Study of the Cigarette Beetle in Tobacco Storage Warehouses. Frank P. Sivik and Joseph N. Tenhet, North Carolina State College, Raleigh.
- 8:42 14. Holly Insect Problems in Oregon. K. G. Swenson and W. C. Adlerz, Oregon State College, Corvallis.
- 8:54 15. The Scarcity of the Brown-Tail Moth in New England. Harvey L. Sweetman, University of Massachusetts, Amherst.

- 9:06 16. A Population Study of the Winter Grain Mite, *Penthaeus major* (Duges), with some Remarks on its Biology. D. Shankar Narayan, University of Kansas, Lawrence.

- 9:18 17. Behavior of Spider Mites in Contact with DDT. H. Bruce Boudreaux, Louisiana State University, Baton Rouge.

9:30 Recess

- 9:42 18. Injury to Fruiting Forms of Cotton by the Cotton Boll Weevil (*Anthonomus grandis* Boh.) T. F. Leigh and Charles Lincoln, University of Arkansas, Fayetteville.

- 9:54 19. Epidemic Infestations of Wheat by a Dermestid, *Trogoderma boron* Beal. Gailen D. White, Stored-Products Insect Laboratory, Manhattan, Kansas.

- 10:06 20. Studies on Resistance of Wheat Varieties to Grain Weevil Attack. Marcos Rameriz Genel and H. H. Schwardt, Cornell University, Ithaca, N. Y.

- 10:18 21. Effect of Seeding Rates and Row Spacings on Resistance of Rescue and Thatcher Wheats to Wheat Stem Sawfly. Philip Luginbill, Jr., Entomology Research Branch, Bozeman, Montana.

- 10:30 22. A General Classification of Available Small Seed Legumes as Hosts for Three Aphids of the Yellow Clover Aphid Complex. Don C. Peters and Reginald H. Painter, Kansas State College, Manhattan.

8:30-11:15 a.m.

#### Section D. Medical and Veterinary Entomology, Washington Room

Chairman: C. B. Philip

Secretary: W. D. Reed

#### Submitted Papers:

- 8:30 18. Residual Sprays for the Control of House Flies. H. G. Wilson, J. C. Keller and Carroll N. Smith, Entomology Research Branch, Orlando, Fla.
- 8:42 19. Organic Phosphorus Compounds for the Control of Resistant House Flies in Dairy Barns. John W. Kilpatrick, H. F. Schoof, and K. D. Quarterman, Public Health Service, Savannah, Ga.
- 8:54 20. Insecticidal Aerosols Against Resistant House Flies. H. O. Schroeder and Howard A. Jones, Fairchild Chemical Division, Baltimore, Md.
- 9:06 21. The Use of Electric-Eye-Controlled Sprayer Against Horse Flies and Other Biting Flies on Cattle in Pennsylvania. Tien-Hsi Cheng, The Pennsylvania State University, University Park.
- 9:18 22. The Readle Sprayer and Cable Type Rubber for Controlling Biting Flies on Cattle in Pennsylvania. Tien-Hsi Cheng, The Pennsylvania State University, University Park.

## Sunday Forenoon

## Notes

- 9:30 23. The Weight Responses of Beef Cattle in Relation to Control of Horn and Stable Flies. L. K. Cutkomp, University of Minnesota, St. Paul.
- 9:42 Recess
- 9:54 24. Further Observations on the Effect of Biting Fly Control on Milk Production of Cattle. Philip Granett and Elton J. Hansens, New Jersey Agricultural Experiment Station, New Brunswick.
- 10:06 25. Tests with Dow ET-57 for Ectoparasite Control on Cats and Dogs. D. E. Howell and R. J. Tonn, Agricultural College, Clemson, S. C.
- 10:18 26. Control of Fleas in Yards. H. G. Wilson, J. C. Keller and Carroll N. Smith, Entomology Research Branch, Orlando, Fla.
- 10:30 27. Artificial Stimulation of Hatching of Latent Eggs of Mosquitoes. William R. Horsfall and Patrick T. M. Lum, University of Illinois, Urbana.
- 10:42 28. The Local Distribution of Eggs of Aedes Mosquitoes. William R. Horsfall, University of Illinois, Urbana.
- 10:54 29. Maintenance of *Psorophora howardi* (Diptera: Culicidae) as a Laboratory Colony. Patrick T. M. Lum and William R. Horsfall, University of Illinois, Urbana.

8:30-12:00 m.

*Section E. Control, Extension and Regulatory Entomology, Subsection b, Plant Pest Control and Quarantine, Panel Room*

Chairman: G. S. Langford

Secretary: G. F. Callaghan

### *Invitation Papers:*

- a. Progress Report on the Khapra Beetle. Dohald L. Shepherd, Plant Pest Control Branch, Washington, D. C.
- b. Progress Report on the Mediterranean Fruit Fly Eradication Program. Ed L. Ayers, State Plant Board of Florida, Gainesville.
- c. Surveys of Central America for the Mediterranean Fruit Fly and the Desirability of Such Surveys in the Plant Quarantine Program. Richard G. Oakley, Plant Quarantine Branch, Washington, D. C.
- d. Setting Up an Emergency Field Identification Service. Richard H. Foote, Entomology Research Branch, Washington, D. C., and Harold A. Denmark, Florida State Plant Board, Gainesville.

8:30-11:30 a.m.

*Motion Pictures*

Grand Ballroom

## ABSTRACTS OF SUBMITTED PAPERS

### Section A: GENERAL ENTOMOLOGY

1. HARBISON, CHARLES F., An Account of a Revisit to the Type Locality of Two Mexican Dragonflies, *Aeshna manni* Williamson and to the Original Locality of the Allotype of *Erpetogomphus natriz* Williamson, Los Parres, Baja California, Mexico.

Los Parres was revisited in November, 1952 from Loreto, Baja California, Mexico by truck, and a few hours passed in the vicinity worked by J. H. Williamson and Dr. William Mann in Sept. 1923. The species collected and observed on this hurried visit and a description of the habitat of each are given. *Erpetogomphus natriz* male (Baja Purissima) Williamson's description and observable differences brought out.

2. HARBISON, CHARLES F., Extension of the Reported Range of a Damselfly, *Enallagma eiseni* Calvert Northward About Two Hundred Air Miles to the Vicinity of Los Angeles Bay, Baja California, Mexico.

Recorded previously in Baja California in the Cape district and as far north as Purissima and Los Parres, the author has collected *Enallagma eiseni* from the spring above the settlement on the shores of Los Angeles Bay about two hundred miles north of the above localities. Specimens from San Jose del Cabo, Baja California, Baja Purissima (topotype) and from Los Angeles Bay are compared and observed differences given.

3. MONTGOMERY, B. ELWOOD, The Classification and Nomenclature of Calopterygine Dragonflies (Odonata: Calopterygoidea).

This is a critique of the suprageneric classification and relationships of the dragonflies (Odonata) which were first given distinct recognition by Leach in 1815. The classification of the species into groups was first made by Burmeister in 1839. These groups were given generic rank by Selys (1840), Charpentier (1840) and Rambur (1842). These original groups have remained remarkably stable through many reclassifications to the review by Tillyard and Fraser (1939-40), although growing to family and subfamily rank. However, because of the Leach-Latreille question concerning the type of the genus *Agrius*, and the shifting of "type" species by Selys and Rambur, the nomenclature has become a labyrinth of names which have been rejected, resurrected or reversed in application to genera and families.

4. SCOTT, D. C., ALLAN HIRSCH AND LEWIS BERNER, The Nymph of the Mayfly *Tortopus*.

During a biological study of the Savannah River, nymphs of the Mayfly *Tortopus incertus* were found in large numbers. This is the first time that the immatures of this genus have been taken. The nymphs honey-comb the clay banks of the river, following the river level up or down as evidenced by abandoned burrows five or six feet above low-water level. Apparently the insect requires two years to develop from egg to maturity. The period of emergence is restricted from late July to early September. Because of the similarity of the distribution of hairs on the legs and the type of burrows occupied by the Nymphs, it is believed that the insect strains its food much as does its African relative *Povilla*.

5. STANNARD, LEWIS J. JR., The Origin of the Families of the Thysanoptera.

The Thysanoptera presumably evolved from a psocid-like ancestor. In the Permian or prior to it, the thrips' prototype probably gave rise to the family

Aeolothripidae. By Cretaceous times, at least, another family, the Heterothripidae, became differentiated. During the Tertiary, three more families, the Merothripidae, the Thripidae, and the Phlaeothripidae, arose. Most likely the Phlaeothripidae stemmed from one of the early divisions of the Thripidae.

6. SELANDER, RICHARD B., The Adaptive and Phylogenetic Significance of Uninterrupted Wing Venation in Coleoptera, with Special Reference to the Genus *Atractocerus*.

The specialized, interrupted wing venation characteristic of most Coleoptera evolved as an adaption for wing folding. Subsequently, evolutionary changes in some groups of beetles have eliminated the necessity of wing folding, with the result that a few genera, notably *Atractocerus*, have evolved uninterrupted venational patterns of deceptively primitive appearance. The functional basis of this specialization is thought to be increased efficiency of flight.

7. SELANDER, RICHARD B., Character Convergence in Two Sympatric Populations of *Lytta* (Coleoptera).

Theoretically, at least, character convergence may occur in sympatric populations as the result of introgressive hybridization, mimicry, or parallel response to environmental factors. A presumed case of non-introgressive convergence in the genus *Lytta* is described and a discussion of the significance of character convergence is presented.

8. ROZEN, JEROME G. JR., Some Problems of the External Anatomy of Beetle Larvae.

A study of the anatomy of the larva of the oedermerid, *Nacerda melanura*, has provided a solution to a number of basic problems pertaining to the morphology of legged orthosomatic coleopterous larvae. These problems, as well as some still to be solved, are discussed.

9. GRANT, HAROLD J., AND JAMES A. G. REHN, Distribution and Origin of the North American Pygmy Grasshopper (Tetrigidae) Fauna.

The North American tetrigid fauna (North of Mexico) comprises 20 species disposed in 7 genera and 2 subfamilies. This fauna is composed of 3 elements with respect to origin, viz., an endemic element, one derived from the north (Europe and Asia) and one which is intrusive from the south. The distribution of these taxa with respect to life zones is discussed.

10. GRANT, HAROLD J. JR., The distribution of the Tetrigid Subfamily Batrachideinae.

The subfamily Batrachideinae includes 16 genera. Of these all but 4 genera are found in the New World. The Neotropical region appears to be the prime center of diversification and the source of the Nearctic fauna. The Ethiopian region possesses 2 genera, one of which is probably derived from an Oriental genus. A single genus is known from the Australian region. The distribution of the subfamily is characterized by the high degree of endemism exhibited in each of the zoogeographic regions it inhabits.

## Section A

11. BELLINGER, PETER F., A New Actaletes (Collembola) with Marked Sexual Dimorphism.

The family Actaletidae was previously known only from one species found on the channel coast of France. The peculiarities of the family are briefly reviewed. The second species, found on wet rocks on the coast of Jamaica, B. W. I., differs from the European species in being sexually dimorphic: the males have greatly elongate antennae and a complex process which appears to be a clasping organ on the hind tibiotarsus. The latter structure, which is unique in the Collembola, suggests that the method of mating is unusual; in most Collembola transferral of the spermatophore is indirect and may not even require the simultaneous presence of males and females.

12. SAILER, REECE I., The Relative Usefulness of Anatomical and Physiological Characters for Recognition of Species and Subspecies of Euschistus (Hemiptera: Pentatomidae).

Cross-breeding studies of stink bugs of the genus *Euschistus* has made available abundant material which has been used to compare the value of anatomical characters with physiological characters in the definition of species and subspecies. Conclusions drawn from the studies are presented. In terms of economy of effort the advantages of recognition from anatomical characters were clearly demonstrated. However, the method has limitations and rearing and cross-breeding studies serve as a valuable check. In addition some basic physiological differences not obviously correlated with structure were revealed.

13. BOHART, RICHARD M., AND R. K. WASHINO, Differentiation of Second and Third Stage Larvae of California *Culex*.

The 12 California species of *Culex* are separated in a key to the second and third larval stages. A short diagnosis and a discussion of variation is given for each stage. In general the same structures used in the fourth stage are of value but they may be less developed. The extent of the anal ring and of the sclerotization of the siphon are characters peculiar to the immature stages.

14. PHILIP, CORNELIUS B., A New Era in Ideas of Systematic Relationships of World Tabanidae Inaugurated by Mackerras, and the Impact on Nomenclature of Horseflies of the Western Hemisphere.

In a current series of reports of which 3 have appeared, and at least 2 more major contributions are anticipated, I. M. Mackerras of Australia has provided the first world-wide application of genitalic structures to a revision of supraspecific taxa of Tabanidae. In conjunction with a consideration of previously familiar characters, a more reasonable picture of geographic relationships and distribution is emerging. This will facilitate improvements in systematization of the fauna of the New World.

15. FORBES, JAMES, A Comparison of the Male Reproductive Systems in Two Doryline Ants.

The male reproductive system of a New World army ant, *Eciton hamatum*, is compared with that of an Old World driver or legionary ant, *Dorylus labiatus*. The arrangement of the organs in the two systems is quite different. In *D. labiatus* there is no testicular capsule or aedeagal bladder, and in *E.*

*hamatum* a seminal vesicle is lacking. In both ants the posterior ends of the vasa deferentia are reduced in diameter and open into the proximal portions of the accessory glands. However, in *D. labiatus* these glands are large, slightly curved, and tubular shaped, while in *E. hamatum* they are long, tightly coiled tubes. In *D. labiatus* the ducts of the accessory glands unite into a long, unpaired, median ejaculatory duct. In *E. hamatum*, these two ducts are bound together by circular muscle, encircle the ventriculus five or six times, and then proceed to the genitalia; the posterior ends of these combined ducts unite to form a short, single ejaculatory duct.

16. STAY, BARBARA A., Colleterial Glands of *Diploptera dytiscoides*.

A study has been made of the morphology, histology, and physiology of the colleterial glands of the viviparous cockroach, *Diploptera*, which produces only a rudimentary oötheca. Although the relative size of the right and left colleterial glands of *Diploptera* is the inverse of that of oviparous cockroaches such as *Periplaneta americana*, the histological appearance of the cells is similar. Morphological and histological changes in the colleterial glands of *Diploptera* indicate that the glands function cyclically in coordination with the maturation of the embryos. However, the development of the embryos seems to be independent of the colleterial glands.

17. FRAENKEL, G., The Nature of the "Alarm Reaction" of Mosquito Larvae and Pupae.

Mosquito larvae and pupae, when submitted to a sudden change in light intensity or to mechanical disturbance, leave the surface of the water and go downward. This phenomenon has been called alarm reaction. It has been shown in experiments that this reaction works by the insects becoming negatively phototactic, and not, as one might assume, by reacting to gravity.

18. CALLAHAN, PHILIP S., Serial Morphology as A Technique for Determination of Reproductive Patterns in Lepidoptera.

There is a regular sequence of continuing change which occurs in the gross composition of the reproductive system and fat body of Lepidoptera throughout the adult life. These changes are dependent upon the age and reproductive history of the imago and are observable by methods of dissection of large samples of imagos at various stages of their adult life. Samples of *Heliothis zea*, *Trichopusia ni*, *Cirphis unipuncta*, *Feltia subterranea*, *Agrotis malefida* and *Prodenia ornithogalli* were taken from light traps or reared and studied. Comparisons were made between the various species.

19. BOUDREAUX, H. BRUCE, Evidence for a Virus Affecting Morphology in Spider Mites.

Breeding experiments indicate that a virus-like substance is transmitted largely through the egg cytoplasm. Spermatozoa are relatively poor transmitters. The effect of infection is to suppress the development of certain setae in females. Males are unaffected.

20. BEER, ROBERT E., Phytophagous Mites of Mexico.

This is a report of a preliminary survey of the plant feeding mites in Mexico. Collecting methods used in the 1955 and 1956 survey are described briefly (Continued on Page 15)



## Section A—Section B

(Continued from Page 14)

ly. A concerted and successful effort was made during the survey to associate the mite species with their host plants. Comparisons of the distribution and importance of certain species in Mexico are made, with suggestions of the possible increasing economic importance of Mexican species as pests of U. S. agriculture.

21. WEEMS, HOWARD V., JR., Refinements in the Use of Offset Printing for the Preparation of Entomological Data Labels.

In the development of an insect reference collection by the Entomology Department of the State Plant Board of Florida, a need developed for a large quantity of data labels. Refinements were made in a technique which employs photo offset printing, so that a supply of hundreds of items can be obtained quickly and inexpensively. Labels obtained in this manner, when correct procedures are followed, are of highest quality. Recommended procedures for preparing material for printing, so that labels can be cut into strips on an automatic cutting machine are given. A system for filing labels is suggested.

### Section B: PHYSIOLOGY AND TOXICOLOGY

1. ROCKSTEIN, MORRIS, Metachemogenesis—A Physiological Interpretation of Metamorphosis Following Emergence of the Adult Insect.

Experimental data from scattered studies will be presented, which indicate that the morphological changes which appear to result in the mature adult (aside from sexual maturation) are actually supplemented by post-emergence maturation changes of a biochemical nature, which the author has termed "Metachemogenesis". These data include biochemical changes at the total organismic and subcellular (mitochondria) level, which appear to reflect a complex series of such biochemical alterations essential to maturation of functions like flight, hitherto not emphasized in considering the phenomenon of metamorphosis in relation to adult emergence. It is suggested that such changes must reflect alterations in function at the higher regulatory level of endocrine secretion, study of which is obviously desirable.

2. BARS, MARY C., The Activity of Dehydrogenase Enzymes during the Metamorphosis of the Mealworm, *Tenebrio molitor*.

Alcohol, malic, and glucose dehydrogenases were found to require DPN. Lactic did not require it during the larval stage but did in the adult. Alcohol and glucose dehydrogenases did not change in activity during metamorphosis; lactic and succinic showed increases toward the end of the pupal stage, and malic followed a definite U-shaped activity curve. The activity of malic dehydrogenase was much greater than that of the other enzymes studied.

3. TRACEY, SISTER KATHLEEN MARIE, S. C., The Influence of Parental Age on the Growth of the Mealworm, *Tenebrio molitor*.

Eggs were collected from newly emerged beetles and from the same individuals 1 month later and again at the end of 2 months. A study of the offspring showed that an increase in parental age decreased the number of molts and increased the rate of growth. The length of time between molts was shortened in larvae from old, as compared with those from middle aged and young parents. At 30° C.

the number of molts is greater and growth is more rapid than at 25° C.

4. LAWSON, FRED A., AND GREGORY B. MULKERN, Studies on Allatectomy and Gonadectomy in Cockroaches (Blattidae-Orthoptera).

Allatectomies have been performed on the males of several species to determine the effects of this operation on sperm formation. Gonadectomies were performed on both sexes to see if the absence of gonads would indicate any endocrine functions of these structures.

5. MULKERN, GREGORY B. AND FRED A. LAWSON, Notes on the Head Glands of the Cockroach (Blattidae-Orthoptera).

The function and structure of manibular glands of several species have been studied; the structure of certain other glands has also been investigated.

6. PATTON, R. L., AND RUTH A. FLINT, Observations on the Variations of Physiological Properties and Functions of the Organs of the American Cockroach, *Periplaneta americana*.

Studies have been made on the normal variations which exist in the physiological properties and the functions of several organ systems of the American cockroach during the period between molts. These are discussed in terms of their importance to experimental physiological research.

7. SIAKOTOS, A. N., AND R. L. PATTON, The Electrophoretic Properties of the Blood of the American Cockroach, *Periplaneta americana*.

The blood of the American cockroach was investigated as to its electrophoretic behavior with buffers ranging from pH=3 to pH=11. The distribution of protein, protein bound carbohydrates, phospholipids, lipids, and sterols were investigated quantitatively. Changes in the electrophoretic substances in the blood were followed through the life cycle and sex differences were also investigated.

8. SACKTOR, BERTRAM, AND DONALD G. COCHRAN, Dephosphorylation of Nucleotides by Insect Flight Muscle.

Insect flight muscle mitochondria dephosphorylate ATP, GTP, ITP, UTP, and CTP. The rates of hydrolysis for these nucleotides are in the order listed above. Mitochondria liberate the two labile phosphates from the purines, ATP, ITP, and GTP. In contrast, all three phosphates are released from the pyrimidines, UTP and CTP. Mg and Mn activate dephosphorylation, the latter being the more potent of the two. Ca is inhibitory. DNP stimulates the hydrolysis of ATP, GTP, ITP and UTP to the same extent. ADP and IDP are competitive inhibitors of ATPase and ITPase, respectively. ADP is also an extremely effective inhibitor of ITPase and GTPase. IDP has no effect on ITPase, but it inhibits GTPase. Neither purine ribodiphosphate inhibits UTPase. From such observations it seems best to conclude that there is in mitochondria a specific nucleoside triphosphatase for each of the nucleoside triphosphates. In addition to the mitochondria, other portions of the flight muscle, myofibrils and sarcoplasm, can hydrolyze ATP, ITP, GTP and UTP. The enzymes in the sarcoplasm are activated by Mg and inhibited by Ca. The effect of Mn depends on the nucleotide being dephosphorylated. The dephosphorylation of these four nucleoside triphosphates by the myofibrils is Ca-activated.



## Section B

### 9. CASE, JAMES F., Studies on the Neuromuscular Apparatus of Cockroach Spiracles.

A previous investigation has demonstrated the rhythmic activity of cockroach spiracles during hyperventilation to be dependent upon central nervous connections via the median nerves. However, spiracles which evidently are completely denervated retain indefinitely the ability to open and close in response to variation in ambient  $pO_2$  and  $pCO_2$ . The investigation of this paradox has centered on the physiology of denervated spiracle muscles and has brought to light a phenomenon, perhaps similar to fasciculation, i.e., spontaneous contractions of individual muscle bundles, which appears to be significant to the continued partial function of denervated spiracles. These studies will be described and related to the more general problem of the irritability of insect muscle.

### 10. CASE, JAMES F., AND R. W. STURM, Attenuation of the Anaesthetic Effect of $CO_2$ on Cockroaches.

A profitable approach to a rational concept of the mode of action of  $CO_2$  as an anesthetic appears to lie through a study of induced tolerance. Investigations of this type will be discussed, including observations on induction and persistence of  $CO_2$  tolerance and on the significance of buffer capacity to the rate of induction of  $CO_2$  anaesthesia.

### 11. CUTKOMP, L. K., AND M. TAHER, The Influence of Alternating Temperatures on DDT Symptoms in the American Cockroach.

Following the injection of equal doses of DDT in cockroaches, cool temperatures ( $15^\circ C.$ ) permit them to show prostration quicker than at higher temperatures ( $30^\circ C.$ ) and recovery can occur at the higher temperatures. When the cockroaches are alternated between the high and low temperatures they appear to be able to withstand the cool temperatures longer, thus will not become prostrate as quickly. DMC, a synergist of DDT for resistant house flies, was used in combination to provide a possible explanation of the results.

### 12. SIVERLY, R. E., Effects of Chilling of Pupae on Subsequent Emergence of Resistant and Non-Resistant House Flies.

Approximate nine and seven percent reductions in emergency occur for each day's chilling in non-resistant and resistant strains. This difference is statistically significant. A linear relationship also exists between periods of pupal refrigeration and delay in subsequent emergence. The difference in retardation of emergence is insignificant in the two strains.

### 13. BARKER, ROY J., Some Effects of Temperature on Adult House Flies Treated with DDT.

The effects, direct and indirect, of eight temperatures on absorption, degradation, and mortality are determined on three strains of house flies which have three dosages of DDT applied topically. No strain differences were found for absorption and degradation in survivors at 6, 24, or 48 hours.

### 14. LINDQUIST, DONALD A., AND PAUL A. DAHM, Some Chemical and Biological Experiments with Thiodan.

Two insecticidally active isomers of Thiodan, an experimental insecticide, have been separated by col-

umn chromatography. Paper chromatographic techniques have been developed which can be used to separate and identify 20  $\mu g$ m. or more of each of the two isomers in the absence of interfering substances. Infrared and ultraviolet spectra of both isomers have also been obtained. The infrared spectra have definite differences while the ultraviolet spectra are identical.

Comparative dosage-mortality curves and  $LD_{50}$  values have been obtained for Thiodan, the two Thiodan isomers, and DDT following topical applications to non-resistant, female house flies. The approximate acute oral toxicity of Thiodan administered in corn oil solution by stomach tube to male, white rats has been determined.

### 15. BLUM, MURRAY S., AND JOHN J. PRATT, JR., The Relationship Between Structure and Insecticidal Activity in Organotin Compounds.

Certain organotin compounds possess a high degree of toxicity to the house fly. An examination of mono, di, tri and tetra alkyl and aryl organotin compounds demonstrates that maximum activity is associated with the number of carbon atoms joined directly to the tin moiety of the molecule.

### 16. BLUM, MURRAY S., AND JOHN J. PRATT, JR., The Relationship between Structure and Synergistic Activity of Compounds Evaluated as DDT Synergists against Resistant House Flies.

A series of DDT analogs with different para substituents has been evaluated synergistically against DDT resistant house flies. The candidate synergists also were evaluated insecticidally against susceptible house flies.

### 17. TAHER, M., AND L. K. CUTKOMP, The Deleterious Effects of DDT on the Oviposition and the Egg Fertility of the Confused Flour Beetle.

When sublethal doses of DDT to adults were incorporated in the flour media the egg production was either completely inhibited or markedly reduced according to the level of DDT. This effect appeared to be physiological. The fertility of the eggs laid in such media was also affected. The effect seemed to be due to a combination of a direct effect of DDT on the embryo and an adsorption of DDT on the egg shell. The ill effects of DDT on oviposition and egg fertility were reversible and immediate.

### 18. KRING, JAMES B., Factors Affecting the Feeding Activity of DDT-Resistant Potato Flea Beetles.

DDT, light, the physical surface of the potato leaf and temperature are all shown to affect the feeding activity of DDT-resistant potato flea beetles. This insect can detect the presence of DDT. Both light and the physical surface of the leaf can be used to counteract this ability. Potato flea beetles fed on DDT treated foliage or dipped in DDT solutions show considerable tolerance to this insecticide.

### 19. LIPFOLD, PAUL C., AND G. S. FRAENKEL, The Physiological Basis of Host Specificity in the Mexican Bean Beetle, *Epilachna varivestis* Muls.

Investigation of the host specificity of the Mexican Bean Beetle for various legumes has indicated that olfaction is of minimal importance in the selection of respective host plants. On the fractionation of several species of legumes, a series of glycosides was isolated which proved to be gustatorily attractive. Chromatographic and capillary analysis procedures

## Section B

revealed the presence of these materials in the foliage as well as in the seeds of certain legumes.

20. KAMAL, ADEL, Comparative Study of the Digestive Enzymes of Several Species of Blow Flies and Flesh Flies.

The distribution of seven digestive enzymes, namely amylase, maltase, sucrase, Lactase, butyrase, pepsin, and trypsin in the various divisions of the larval digestive system of flies of thirteen species representing nine genera with a wide range of food habits were determined. Tissues of midgut A & C showed the richest variety and number of digestive enzymes. No pepsin or amylase activity was found in any part of the digestive system of any species studied. A definite reduction in digestive enzyme type and distribution is reported for the parasitic forms with complete absence of enzymatic activity in the hindgut. The digestive enzymes of larvae reared aseptically on 5 to 10% sterile blood agar were determined and compared with those of non-sterile larvae. The activity of carbohydrases reported from non-sterile larvae was due to bacterial action.

21. GREENBERG, BERNARD, The Rule of Sucrose in the Survival of Adult House Flies.

It has generally been accepted that house flies need to drink at least every 24-48 hours to survive. Flies have been kept at certain temperatures and humidities on various diets to test this hypothesis. It has been found that a utilizable sugar such as sucrose can maintain life for from 7 to 21 days without water. Water without sucrose maintains life up to about 3 days.

22. SCHMIDT, CLAUDE H., AND PAUL A. DAHM, The Effects of Organic Solvents on Colorimetric Tests for Piperonyl Butoxide and the Fate of  $C^{14}$ -Labeled Piperonyl Butoxide in the Madeira Cockroach, *Leucophaea maderae* (F.).

The effects of organic solvents on two colorimetric tests used for the determination of piperonyl butoxide were investigated. The selection of the solvents was important since much variation in the intensity of the colored complexes was observed with different solvents. The absorption and excretion of radioactive piperonyl butoxide was studied following topical application to the Madeira cockroach. The synergist was rapidly absorbed and 50% of the radioactivity in the applied dose was recovered over a 7-day period from feces extracted with 80% aqueous acetone. Paper chromatographic analysis of fecal extracts showed that less than 50% of the radioactivity in the feces was piperonyl butoxide, the remainder consisted of unidentified water-soluble metabolites.

23. ROBBINS, WILLIAM E., THEODORE L. HOPKINS, AND GAINES W. EDDY, The Fate of  $P^{32}$ -Labeled Dow ET-57 in the Bovine Body.

The metabolism and excretion of  $P^{32}$ -labeled Dow ET-57 (0, 0-dimethyl 0-2, 4, 5-trichlorophenyl phosphorothioate) in a Guernsey bull calf has been studied following its oral administration at the rate of 100 mg/kg. Analysis of the blood sampled at intervals and the quantitatively collected urine and feces by radiometric assay, partition coefficients, and paper chromatography demonstrated the efficient absorption, degradation, and excretion of the compound. Approximately 50 percent of the total dose was accounted for in the urine at 30 hours and about 90 per cent in the urine and feces at the end of 10

days. Unchanged Dow ET-57 was present in the extracts of blood and feces while only metabolic products were found in the urine.

24. AUERBACH, S. I., AND MANFRED ENGELMANN, Effects of Gamma Radiation on Population Growth in Collembola.

Data of a previous study indicated that certain Collembola populations irradiated while in their natural habitat increased in numbers above the control population levels. The hypothesis that the radiation stimulated population growth was tested utilizing the species *Proisotoma minuta*. Starting with known numbers of individuals per sample, various numbers of samples were given instantaneous air doses of gamma radiation of 3,000, 5,000 and 7,000 roentgens. Population growth data was obtained by using a visual sampling method. After 20 or more days post irradiation, individuals were sacrificed and total counts made. Rate of growth of the irradiated populations appeared to be less than that of the controls. Growth was not inhibited and eventually the irradiated populations probably would approach the control levels. Increase in numbers of Collembola, if any, above control levels can be explained on the basis of population phenomena, rather than a direct beneficial effect of radiation.

25. HOWDEN, H. F., AND S. I. AUERBACH, Some Effects of Gamma Radiation on the Reproduction of *Trogoderma sternale* (Coleoptera: Dermestidae).

Gamma radiation from a  $CO^{60}$  source was used to treat 2100 larvae of *T. sternale*. Each of three series received doses of 1, 2, 3, 4, 5, 6 and 10 thousand r, at the rate of 19 r/sec, one series receiving the total dose in one treatment, the second receiving 1/5 of the dose each day for 5 days, and the third series receiving 1/5 of the dose on the same day of each week for 5 weeks. There was no immediate mortality in any of the replicates. Some of the larvae in each series survived the 10,000 r dose for at least 4 months, but did little feeding and actually became smaller in size. Doses from 1000 to 4000 r delayed development to the adult stage but did not entirely inhibit reproduction. Generally, reproduction was depressed by doses greater than 2000 r and completely inhibited by doses above 5000 r.

26. JAYNES, H. A., AND P. A. GODWIN, Sterilization of the White-Pine Weevil with Gamma Radiation.

In dispersion studies of the white-pine weevil it was contemplated that large numbers of weevils, tagged with an isotope, would be released in the field. Since external tagging with phosphorous-32 does not sterilize the weevils, a simple method of mass sterilization was sought. Adult weevils were exposed to 5,000; 10,000; and 20,000 roentgens from a cobalt-60 source. Both sexes were sterilized at all radiation levels. Non-irradiated females mated with irradiated males produced infertile eggs. These females produced fertile eggs when normal males were introduced in the culture.

27. LOVELL, J. BYRON AND CLYDE W. KEARNS, Inheritance of Ability to Synthesize DDT-Dehydrochlorinase and its Relationship to DDT-Resistance in the House Fly.

The DDT-dehydrochlorinase activity in DDT-Resistant and susceptible house flies, in the  $F_1$  and  $F_2$  generations from reciprocal crosses between these strains, and in the backcrosses between the  $F_1$  gener-

## Section C—Subsections a and b

ation and susceptible flies was correlated to the level of resistance determined by dosage-mortality curves.

It was indicated by the data obtained that there was a correlation between the level of resistance determined by topical application with DDT and the concentration of DDT-dehydrochlorinase.

### Section C: BIOLOGY

#### Subsection a Biological Control

1. ZIMMACK, HAROLD L. AND TOM A. BRINDLEY, Effect of the Protozoan, *Perezia pyraustae* Paillot, on the European Corn Borer.

The protozoan, *Perezia pyraustae*, is an intracellular parasite that infects all stages of the European corn borer. In a group of corn borer larvae that were experimentally infected with *Perezia*, 56 percent developed into adults as compared with 77 percent in a group not infected. Infected female moths averaged 3 days shorter life and produced an average of 39 fewer eggs than uninfected moths. In a lot of female moths collected during copulation in moth emergence cages, those moths that were infected with *Perezia* averaged 3 days shorter life, and laid 9 fewer egg masses and 47 percent fewer eggs, than those not infected. Transovarial transmission of the protozoan was demonstrated in the ovary of the corn borer when spores were shown passing from the region of infected nurse cells into the developing oocyte. Infected males did not transmit the disease through copulation with uninfected females.

2. YORK, GEORGE T., Tests with the Fungus, *Beauveria* sp., for Control of the European Corn Borer.

Applications of *Beauveria* spores to field corn caused a high mortality of first-generation borers. In four experiments in 1955 the average mortality of the corn borer was 88 percent when dry sterilized corn meal was used as a carrier for the spores and 77 percent when granulated clay was the carrier. In 1956 corn meal was again superior to clay as a carrier. Results were variable in tests designed to determine the amounts of *Beauveria* and carrier necessary for satisfactory control. Late treatments against large borers gave somewhat better control than early treatments against smaller larvae. On three occasions the writer suffered a severe allergy from working in high concentrations of *Beauveria* spores. Workers with this fungus should avoid excessive exposure to the dry spores.

3. TASHIRO, H., Susceptibility of European Chafer and Japanese Beetle Larvae to Different Strains of Milky Disease Organisms.

Third-instar larvae of European chafers were more susceptible than Japanese beetle larvae to type A regular and type A DeBryne strains of *Bacillus popilliae* and type B *Amphimallon* strain of *B. lentimorbus* in spore injection and ingestion tests at 70 and 80° F. Japanese beetle is the regular host to the first strain and the European chafer is the regular host to the other two strains. Chafers were slightly more susceptible to the regular strain and much more susceptible to the type B *Amphimallon* strain than Japanese beetle larvae. Chafer larvae were most susceptible to the type A DeBryne strain, but Japanese beetle larvae were practically immune to it. This strain offers the greatest promise of reducing chafer infestations in western New York.

4. GLASS, E. H., Laboratory and Field Tests with Granulosis Disease of Red-banded Leaf Roller.

Granulosis, *Bergoldia clistorhabdion*, is present in some New York orchards but it has not been observed to be an important population check. Laboratory tests show it to be readily transmitted to young larvae. The disease incidence has not been altered by the presence of several common fungicides and it may be stored at below freezing temperatures for at least 2 years without noticeable loss of virulence. Field tests show that suspensions of diseased larvae can be used to spread the disease but that immediate commercial control of the insect has not been obtained.

5. CLAUSEN, C. P., The Reproductive Rate of Entomophagous Insects in Relation to That of Their Hosts.

There is a great variation in reproductive capacity of parasites and predaceous insects, some species being capable of producing thousands of progeny in each generation. This capacity, in general, is not related to the reproductive capacity of the host, and has little or no bearing on the effectiveness of a species in biological control.

6. TOWNES, HENRY, Biological Characteristics of Taxonomic Groupings in the Ichneumonidae.

The major taxonomic divisions of the Ichneumonidae usually have characteristic biologies and hosts. Biologic variations correlated with major taxonomic divisions can be found in whether the larva is an external or an internal parasite, whether host larvae or pupae are attacked, whether the parasite is primary or secondary, and even in such details as the placement of the egg within the host. Some subfamilies or tribes are almost entirely restricted to certain groups of hosts while others have a wide host range.

### Section C. BIOLOGY

#### Subsection b Apiculture

1. HAYDAK, MYKOLA H., Morphological Changes During the Life of the Honey Bee.

Morphological changes in the salivary, mandibular, poison and pharyngeal glands, Malpighian tubules, fat body and aenocytes, poison sac, ovaries and testes during the life of the honey bee were followed and described.

2. TUCKER, KENNETH W., Automictic Parthenogenesis in the Honey Bee (*Apis mellifera* L.)

Unfertilized eggs of unmated queens and laying workers produced a small proportion of workers, and, more rarely, gynandromorphs and mosaic males. The proportion of parthenogenetic workers was highest (usually 1% or less, but as high as 7%) during accelerated oviposition just after laying begun or following an artificially induced cessation of oviposition. Few, if any, workers were produced during sustained oviposition.

An analysis of the segregation of marker genes in parthenogenetic workers from heterozygous unmated queens indicated that the workers were automictically produced by development from the diploid polar union nucleus. This same mechanism seems the most plausible explanation for the origination of the gynandromorphs and mosaic males.



## Section C—Subsections b, c and d

3. TUCKER, KENNETH W., An Ecological Approach to Alsike Clover Pollination by Honey Bees.

Honey bee pollination of alsike clover was studied on an area basis. Honey bee colonies were found to be more efficient pollinating units where competition for honey bee visits by other bloom was the least. Fields of blooming sweetclover and additional fields of alsike clover bloom presented most of the competition.

4. PETERSON, ALLAN G., Honey Bees, Bumble Bees, and Competing Flowers as Factors in Pollination of Red Clover in Minnesota.

Honey bees have been found to be effective pollinators of red clover in Minnesota under conditions in which there is little flower competition from sweetclover and to some extent from alfalfa. The greatest populations of honey bees occurred in the fields located nearest the apiaries. Results indicate that bumble bees were approximately twice as efficient as honey bees in pollinating red clover. However, bumble bees are not sufficiently abundant to be relied upon for adequate pollination.

5. RASHAD, SALAH EL-DIN, An Electrical Machine for Periodical Collection of Pollen Collected by the Honey Bee.

The influence of the weather factors on the activity of the honey bee in pollen collection was studied by means of an electrically operated machine which collected the pollen gathered by the bees periodically. An electrically operated turntable was supplied with eight pans, each of which remains beneath the pollen trap for the desired period.

6. ANDERSON, E. J. AND F. R. SHAW, The Effects of Certain Fungicides on Honey Bees.

In recent years the practice of using a fungicide during apple blossom has been recommended in several states. In order to determine the effects of such applications on honey bees, some of the fungicides more commonly used were applied to caged bees by commercial orchard sprayers. The results of such experiments are reported.

### Section C: BIOLOGY

#### Subsection c, Relations of Insects to Plant Diseases

1. SWENSON, K. G., Vector Specificity of Three Aphid-Borne Viruses.

Tests have been carried out with a number of aphid species to determine their ability to transmit bean yellow mosaic, alfalfa mosaic and cucumber mosaic. The significance of these results is discussed in relation to the problem of the specificity of transmission of non-persistent aphid-borne viruses.

2. CHALFANT, R. B. AND R. K. CHAPMAN, Some Studies on the Aphid Transmission of Brassica Viruses 1 and 2.

Transmission studies with cabbage and green peach aphids indicate that *Brassica virus 1* appears to be transmitted in a typically non-persistent manner. Transmission of *Brassica virus 2* appears typically non-persistent by the green peach aphid but shows some characteristics other than those of non-persistent types when transmitted by the cabbage aphid.

3. McEWEN, F. L., W. T. SCHROEDER AND A. C. DAVIS, Host Range and Transmission of Pea Enation Mosaic Virus.

Greenhouse tests showed that the pea aphid could acquire sufficient virus to infect peas in as short a feeding period on an infected pea plant as 2 hours and could infect pea plants in 5 minutes following expiration of the necessary latent period. Under the experimental conditions employed, the pea aphid readily transmitted the virus from pea, hairy vetch, common vetch, rough peavine and crimson clover but was much less efficient in recovering it from white clover, sweetclovers and alfalfa.

4. DAVIS, A. C., W. T. SCHROEDER AND F. L. McEWEN, Control of Pea Enation Mosaic in Peas with Insecticides.

Data are presented showing pea enation mosaic incidence and yield of peas following single and multiple applications of various aphicides. Yields of shelled peas were not always appreciably increased by significant reduction in virus incidence.

5. CHAPMAN, R. K. AND R. B. CHALFANT, Attempts to Control Some Vegetable Viruses with Insecticides.

Tests were conducted with several insecticides, particularly those of a systemic nature with long residual properties in an attempt to prevent transmission of such vegetable viruses as cabbage mosaic, cucumber mosaic, bean virus 2, potato virus Y, and aster yellows. Prevention of transmission was obtained with persistent type after yellow virus but in many cases no results were obtained with the non-persistent viruses, particularly when a considerable proportion of the virus source was from outside the field.

### Section C: BIOLOGY

#### Subsection d, Ecology and Bionomics

1. CALLAHAN, PHILIP S., Oviposition Response of the Imago of the Corn Earworm *Heliothis zea* (Boddie) to Various Wavelengths of Light.

In cages with a host plant and a villous, lighted oviposition surface, the oviposition surface received most of the deposited eggs. Various wavelengths of light of equal intensities were projected on villous oviposition surfaces. The number of eggs deposited on opposite villous oviposition surfaces lighted with competing wavelengths of light were the criteria for determining oviposition preference.

2. CALLAHAN, PHILIP S., Reproductive Behavior and Oviposition of the Corn Earworm, *Heliothis zea* (Boddie).

The behavior of caged imagos from emergence to death is traced.

3. DOUGLASS, J. R., K. E. GIBSON, W. E. PEAY, AND J. W. INGRAM, Western Bean Cutworm as a Pest of Corn.

The western bean cutworm is a native insect that has changed its host plants from nightshade and ground cherry to beans and in 1954 was observed for the first time as a pest of corn in southern Idaho. The larvae feed on the tassel, blades, stalk, and ear.

## Section C—Subsection d

### 4. HARTZELL, ALBERT, *Matsucoccus* Bark Scale.

Some observations on the seasonal history, host range and cold hardiness of *Matsucoccus resinosae*.

### 5. SPINK, WILLIAM T., Some Observations on the Biology of Two Species of Ground Pearls.

Description of part of the life history of *Eumargarodes laingi* and *Margarodes meridionalis* as studied at Wilmington, North Carolina during the spring, summer and fall of 1956.

### 6. MEAD, FRANK W., Leafhoppers from Turf in Gainesville, Florida.

At the University of Florida Experiment Station, sweeps were taken on seven different turf plots and from the five varieties of Bermuda-grass forming a putting green. Collections were made about every two weeks over a period of several months. The most abundant leafhopper genera were *Graminella*, *Deltoccephalus*, *Exitianus* and *Carneocephala*. Comparisons were made to find which grasses supported the smallest populations. Manilagrass (*Zoysia matrella*) consistently had the fewest insects, followed by St. Augustine grass. Other grasses tested were Bermuda, centipede, Pensacola bahia and carpet.

### 7. MIDDLEKAUFF, WOODROW W., Relationship of Lygus Bug Populations to Blackeye Bean Necrosis.

Two species of lygus bugs, *L. hesperus* and *L. elisus* cause necrotic spots to over 14 per cent of untreated blackeye beans in central California. Based upon comparative population samples using a standardized sweep net, it is possible to predict the amount of damage that will be present at harvest time. This knowledge makes it possible to control damaging populations with a minimum number of insecticide treatments.

### 8. HUMMEL, CLEO MARY, The Biology and Ecology of the Jewelweed Flower-Bud Midge *Schizomyia impatiens*.

A cecidomyid gall midge previously known as *Cecidomyia impatiens* since 1862 was found, upon examination of adults, to belong to the genus *Schizomyia*; thus the midge is mentioned under a new name combination. The salient features which place it in this genus will be mentioned briefly. The major part of the paper is to be devoted to a summary of the life history of the midge and to ecological factors involved. A brief description of the gall and an explanation of rearing methods will also be given.

### 9. HURD, JR., PAUL D., Ecological Observations on the Vespertine Bee *Lasioglossum* (*Sphecodogastra*) *aberrans*, a Pollinator of Evening Primroses.

The subgenus *Sphecodogastra* contains four species of vespertine bees all of which, in so far as known, obtain their pollen from the evening primrose family Onagraceae. A study of one of these species, *Lasioglossum* (*Sphecodogastra*) *aberrans*, has shown that it has attained a virtual synchronous relationship with the evening primrose from which it obtains pollen. The influence of this flower relationship on the nesting activities of the bee are manifest in the physical arrangement of the burrow. Light intensity apparently is one of the more important factors that serves as a timing mechanism for pollen collection.

Brief comparative notes on the other three species of the genus are discussed.

### 10. LINSLEY, E. G., Competition Among Some Maternal Bees Which Collect Pollen from *Oenothera*.

In so far as known, the andrenine bees of the subgenus *Onagradora* collect pollen only from *Oenothera* or related members of the Onagraceae. About 15 described species have been assigned to the group, all but two of which occur in California, with as many as four or five species collecting pollen from a single species of *Oenothera* in a given locality in a brief period beginning at dawn or following the sunrise, depending on the blooming period of the plant species. Within this brief period there appears to be a division of activity times of the pollen collecting females and during the blooming period of the flower, a division of seasonal activity. Apparently these closely related species arose in an allopatric manner, have since come together, and are minimizing competition by a partial division of the diurnal and seasonal periods when the plant pollen is available.

### 11. KAMAL, ADEL AND M. T. JAMES, Comparative Study of the Bionomics of Several Species of Blow Flies and Flesh Flies.

Thirteen species representing nine genera within the families Sarcophagidae and Calliphoridae were reared under various conditions of controlled temperature and relative humidity. Ecological factors operative in determining distribution and density of the species under consideration are compared and discussed. Particular attention is given to the effects of insufficient food supply on the growth and development of both adults and immature stages. Under severe shortage of food supply the mortality varied from one species to the next and is dependent upon whether the larvae had obtained the minimum food requirements to satisfy the physiological level of their metamorphosis and further their successful development.

### 12. SIMEONE, JOHN B., In Vitro Humidity Requirements of the Black Carpenter Ant.

Females of the black carpenter ant *Camponotus herculeanus pennsylvanicus* collected either during their solitary peregrination soon after the swarm or after establishment in a suitable site for next initiation, were placed individually in wood cells at various relative humidities. Egg laying occurred at relative humidities ranging from 30 percent to 100 percent. However, longevity of the female was markedly greatest at 90 percent and 100 percent RH.

### 13. SIVIK, FRANK P. AND JOSEPH N. TENHET, An Ecological Study of the Cigarette Beetle in the Tobacco Storage Warehouse.

Ecological data, including fecundity of females, light trap counts and life cycle of the cigarette beetle are presented. This study was made in a tobacco storage warehouse with beetles reared on flue-cured tobacco.

### 14. SWENSON, K. K., AND W. C. ADLERZ, Holly Insect Problems in Oregon.

The holly bud moth, *Rhopobota naevana ilicifoli-ana*, and the soft scale, *Coccus hesperidum*, are the most important insect pests of holly in Oregon. During the past two years, control experiments and observations on the seasonal cycle of these and less important pests of holly have been carried out.



## Section C—Subsection d. Section D

15. SWEETMAN, HARVEY L., The Scarcity of the Brown-Tail Moth in New England.

An analysis from the literature and biology of the brown-tail moth is being made of the distribution and abundance in New England. It now occupies an area much reduced over that formerly inhabited. Causal factors of the reduction are being sought.

16. NARAYAN, D. SHANKAR, A Population Study of the Winter Grain Mite, *Penthaleus major* (Duges) With Some Remarks on its Biology.

*Penthaleus major* has occurred sporadically as a pest of seasonal importance on wheat, barley, oats and also some leguminous crops in states of Arizona, California, Kansas, Oklahoma and Texas. The injury occurs during cool, wet winter and spring months and results in bleaching and whitening of the attacked foliage. The mites are gregarious in habit, feeding in clusters on leaves.

A population study since 1954 has revealed that three generations of this mite occur each year in Kansas. Population peaks are subject to climatological and other related ecological phenomena. Two peaks stand out prominently, the first in December-January and the second in March-April, the latter being of a higher magnitude. Temperature, humidity, seasonal precipitation and other factors are studied as they affect the life history and abundance of these mites.

17. BOUDREAUX, H. BRUCE, Behavior of Spider Mites in Contact with DDT.

There seemed to be little or no effect upon longevity, rate and volume of egg-laying, and hatching of eggs when two species of spider mites were treated with 10% DDT applied at the rate of 10 pounds per acre. Newly hatched nymphs are made restless, and feeding seems to be interfered with.

18. LEIGH, T. F. AND CHARLES LINCOLN, Injury to Fruiting Forms of Cotton by the Cotton Boll Weevil (*Anthonomus grandis* Boh.).

A summary of four years research on the relationship of the cotton boll weevil to the cotton plant, in a search for factors of resistance or tolerance to weevil injury.

19. WHITE, GAILEN D., Epidemic Infestations of Wheat by a Dermestid, *Trogoderma boreon* Beal.

This species is showing the ability to develop large populations in stored wheat in the wheat belt, on the same order that occurs in barley and grain sorghum in Arizona and California infested by its close relative, the khapra beetle, and all known serious infestations are being kept under observation. Records of population trends, exploratory control studies, and the effect of environmental factors are included.

20. GENEL, MARCOS RAMERIZ AND H. H. SCHWARDT, Studies on Resistance of Wheat Varieties to Grain Weevil Attack.

Twenty varieties of wheat exposed to granary and rice weevil attack for three months showed significant differences in percentage of kernels damaged. Moisture content of samples was adjusted to approximately 14 percent, and they were kept in a room where temperature was maintained at approximately 75 degrees, and relative humidity at approximately 70 percent. Undamaged seed will be multiplied and retested.

21. LUGINBILL, PHILIP, JR., Effect of Seeding Rates and Row Spacings on Resistance of Rescue and Thatcher Wheats to Wheat Stem Sawfly.

Experiments were conducted in sawfly-infested fields to determine the effect of seeding rates and row spacings on wheat stem sawfly activity and resistance in the spring wheats, solid-stemmed Rescue and hollow-stemmed Thatcher. The basic rate of seeding was 1 bushel per acre with twelve-inch spacing between rows. Other rates used were one-half, two, and four times this amount in three-, six-, and twelve-inch spacings.

Rescue was more resistant to sawfly cutting than Thatcher. Sawfly infestation and cutting decreased as the rate of seeding increased. Decrease in sawfly cutting in plots with heavy seeding rates was due in part to a decrease in infestation, that was in turn associated with a decrease in moisture in stems on July 15, diameter of stems, and plant height at peak of oviposition. Apparently, sawflies selected the larger more succulent stems in the lighter seedings for oviposition.

22. PETERS, DON C. AND REGINALD H. PAINTER, A General Classification of Available Small Seeded Legumes as Hosts for Three Aphids of the Yellow Clover Aphid Complex.

The interrelationships of over 70 small seeded legumes with the spotted alfalfa aphid (currently known as *Therioaphis maculata* or *Pterocallidium* sp.), yellow clover aphid (*Pterocallidium trifolii*) and the sweetclover aphid (*Myzocallidium riehmii*) have been studied in cooperation with the Entomology Research Branch, Agricultural Research Service, U.S.D.A. Studies have been confined largely to the greenhouse. The sweetclover aphid finds its hosts in the two genera, *Melilotus* and *Trigonella*; the other species have differing host relationships throughout: *Medicago*, *Melilotus*, and *Trigonella*. Of the species studied fifteen were susceptible to the sweetclover aphid while twice this number were susceptible to the other two species. Plants of other genera are generally immune to all three aphid species. Alfalfa is not attacked by the yellow clover aphid or the sweetclover aphid; and most plants of sweetclover are not injured by the yellow clover or the spotted alfalfa aphid. Four plant species in *Melilotus* and *Trigonella* serve as hosts about equally well for all three aphid species.

## Section D: MEDICAL AND VETERINARY ENTOMOLOGY

1. GRIFFITH, MELVIN E. AND ERNESTINE B. THURMAN, The Status of Malaria Control in Thailand.

Prior to 1950 reported malaria deaths in Thailand averaged more than 45,000 in an estimated three to five million cases per year occurring in a population exceeding 18,000,000. *Anopheles minimus* is the only vector among some 40 reported anophelines. *Plasmodium falciparum* is responsible for 69% of the clinical cases, *P. vivax* for 30%, and *P. malariae* for 1%.

The Thai Malaria Control Program, begun in 1931, has been expanded since 1951 with the cooperation of the U. S. International Cooperation Administration to protect over 10,000,000. Three years of DDT residual house-spraying, augmented by distribution of anti-malaria drugs, appear to be sufficient to break the malaria transmission cycle. In uncontrolled areas *A. minimus* was found in 40.6% of the houses inspected, while in houses inspected after one, two,

## Section D

and three years of control, *A. minimus* was found in 0.14%, 0.6%, and none respectively.

It is expected that the homes in the major malarious areas will have been sprayed three times by 1957, at which time a program of protective surveillance and localized control operations may be adequate. It is anticipated that the control of *A. minimus* will make possible the eradication of malaria from Thailand.

2. GILBERT, I. H. AND H. K. GOUCK, Influence of Surface Color on Mosquito Landing Rates.

Attractant tests comparing landing rates on colored paper disks were conducted with *Aedes aegypti* and *taeniorhynchus*. The disks were treated with dyes of the primary and secondary colors in a range of shades reflecting specific amounts of light under standardized conditions. Against *aegypti* the darker shades of each color attracted the most mosquitoes. With disks reflecting about 40 foot-candles of light the attractiveness of the colors was in this order: Yellow, yellow plus red, red, yellow plus blue, red plus blue, black, and blue. In tests with *taeniorhynchus* with disks reflecting 40 foot-candles the order of attractiveness was: Yellow plus red, yellow plus blue, yellow, blue, red plus blue, red, and black.

3. MEAD, FRANK W., Seasonal Biting Rates of Mosquitoes in a Central Ohio Woods.

Weekly mosquito collecting trips were made to Blacklick Woods, part of the Columbus, Ohio Metropolitan Park System, during a five year period from 1949 through most of the 1953 season. Seventeen species were taken in the act of biting. The only *Anopheles* found was *punctipennis*. No specimens of *Culex* were taken in the act of biting. The worst pests in the first half of the season were *Aedes canadensis* and *Aedes stimulans*. In late summer *Aedes trivittatus* and *Aedes vexans* were the worst, but *Aedes triseriatus* or *Psorophora ferox* sometimes became dominant. The consolidated biting rate of all species reached a peak about the last of June. The last species taken in the fall was *A. vexans*.

4. BURGESS, ROBERT W., Notes on Number of Branches of No. 2 (Antipalmate) Hair in *Anopheles* and Their Variations Through Selective Breeding in *Anopheles freeborni*.

The fourth stage larvae of most American anophelines exhibit a variable number of branches on hair No. 2 (antipalmate) of abdominal segments 4 and 5. Experiments in selective breeding designed to alter the normal hair pattern of *A. freeborni* have been conducted.

Tables showing variation in the chaetotaxy of other species are given for comparison. The results of the experiments are reported.

5. VENARD, CARL AND ELDEN G. BURCHAM, *Vorticella* on Larvae of *Aedes canadensis* and *Aedes stimulans*.

Third and fourth instar larvae of *Aedes canadensis* and *Aedes stimulans* were observed to have a typical sluggish movement and the posterior several abdominal segments were almost white. Laboratory examination revealed *Vorticella* attached to most of the body surface and they were very numerous on abdominal segments three to eight inclusive. In the field and in the laboratory infested larvae often failed to pupate. *Aedes aegypti* did not become infested when reared with infested *Aedes stimulans*.

Preliminary study of serial sections of infested larvae has not revealed lesions due to *Vorticella* nor the presence of other microorganisms.

6. GREENBERG, BERNARD, Survival of Enteric Pathogens in Larvae and Pupae of the House Fly.

*Shigella flexneri* and three species of *Salmonella* were separately used to infect batches of aseptically reared larvae. Destruction of bacteria begins in the pre-pupa stage and is most evident during the first two days of pupation. Data from control studies involving larvae with a normal flora are also presented.

7. JONES, R. H., A Report on the Colonization of *Culicoides variipennis* (Coquillett), the Possible Vector of Bluetongue of Sheep in the Southwest.

This species of biting midge has been reared through several successive generations in the laboratory. The main colony is now on its sixth laboratory generation and is producing adult flies at the rate of about 100 per day. Nourishment consists of water and sugar for the males and, in addition, blood for the females. A rabbit is used in providing blood meals, as the adult females readily engorge from the inner surface of the ears. The larval medium consists of fresh cow manure mixed with soil and water. All stages of the colonies are kept in a constant temperature room set at 75° F. with the relative humidity at 50 percent. The life cycle in the laboratory is about 30 days in duration, the approximate breakdown being as follows: egg - 2, larva - 23, pupa - 2, and pre-oviposition period - 3.

8. WALL, W. AND H. JAMNBACK, Sampling Methods Used in Estimating Larval Populations of Salt-Marsh Tabanids.

Two methods of sampling salt-marsh tabanid larval populations were used on Long Island to evaluate the effectiveness of experimental larval control tests. The first method involved application of dilute New Jersey larvicide to cleared areas of salt-marsh and subsequent collection of larvae appearing at the surface of the marsh. The second method involved cutting a square foot slice of sod about 1.5 inches thick from the marsh surface and drying the sod in a berlese funnel. The larvae emerging from the sample were collected in a jar of salt water beneath the funnel.

9. DARSIE, RICHARD F., JR. AND GEORGE ANASTOS, Geographical Distribution and Hosts of *Ixodes texanus* Banks, Acarine, Ixodidae).

This tick, little known in Eastern United States, now occurs in considerable numbers at several localities along the Atlantic Seaboard. The recent build up and possibility of its further spread in the East has prompted a review of our present knowledge of this ectoparasite. A complete record of its present distribution and host index are included.

10. TRAVIS, B. V., Worldwide Compilations of Arthropods of Medical Importance.

Work has been in progress for the past five years on a compilation of information on arthropods of medical importance for the world. Information itemized separately for each country includes, species, season of adult activity, breeding habitat of the immature stages, pertinent information on adult activity and disease transmission and the distribution within each country.

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A technique has been devised for indexing the literature on hand-sort punch cards. The basic references to date are based largely on the Review of Applied Entomology and the Tropical Disease Bulletin. A first draft is complete for the Western Hemisphere and nearly ready for typing for most of the Australasian Region.

11. BRANDSTEIN, M., A. H. BAUMHOVER, AND W. D. NEW, Development of Attractants for the Screw-Worm Fly.

Methods and conditions for testing, the nature of attractants, and the types of materials studied are discussed. The problems, progress, and results of field tests of attractants are presented.

12. BAUMHOVER, A. H. AND W. D. NEW, Colonization of a Florida Strain of the Screw-Worm Fly.

Research is in progress to develop methods for the eradication of the screw-worm fly from its normal overwintering site in peninsular Florida through the release of laboratory reared and sterilized male screw-worm flies. Consequently collections of screw-worm larvae were made at several locations in Florida and at one location in southern Georgia to establish a Florida colony. Results of mating tests to develop a vigorous and long-lived Florida strain are discussed.

13. COLE, M. M., M. D. COUCH, G. S. BURDEN, AND I. H. GILBERT, Further Studies on Resistance of Human Body Lice to Insecticides.

A highly DDT-resistant strain of body lice lost some, but not all, of its resistance after 45 generations without exposure to the insecticide. High resistance developed in susceptible lice exposed to low concentrations of DDT to give a very low rate of selection, but not when mortality was no greater than that in check lots. Continuous rearing on cloth treated with lindane, lauseto neu, synergized pyrethrins, and Strobane failed to produce a high degree of resistance.

14. BARKER, J. G., J. M. GRAYSON AND M. LEVITAN, Inheritance of resistance to Lindane in the German Cockroach.

Determinations were made of the resistance to lindane of adult male and female German cockroaches in the following strains: (a) lindane-resistant and nonresistant (parental), (b)  $F_1$  and  $F_2$  generations of reciprocal crosses between the parental strains, (c)  $F_1$  and  $F_2$  generations of selected back crosses, (d) progeny of pair matings within parental strains, and (e) successive generations of an originally resistant strain in which selection was discontinued. The dosage-mortality data obtained were fitted to regression lines, and appropriate conclusions made.

15. JARVIS, F. E. AND J. M. GRAYSON, Residual Effectiveness of Different Insecticide Formulations for Control of Resistant and Non-Resistant German Cockroaches.

The residual effectiveness in controlling chlordane-resistant and non-resistant German cockroaches was determined for different insecticide formulations applied to tempered masonite, metal, and wood surfaces by dipping. Adult females from each strain were placed on treated panels at intervals of 21, 30, and 60 days following treatment. The insecticide formulations involved chlordane, dieldrin, malathion, diazinon, dipterex, "4124", malrin, allethrin, and

selected combinations for determination of synergistic action.

16. MORRISON, FRANK O., Variations in the Ratio of the Width to the Length of the Second Abdominal Sternum of Several House Fly Strains and the Relation of the Ratio to DDT-resistance.

The ratio of the width to the length of the second abdominal sternum of twenty-five specimens of each sex from nine laboratory reared house fly strains was recorded. With a few exceptions the strains all differed from each other in this characteristic. Different workers were able to arrive at a reasonably good agreement on the measurements. These data supply further evidence for a direct relation between the size of this ratio and DDT-resistance.

17. JAMNBACK, H. AND W. WALL, Experimental Control of Salt-Marsh Tabanid Larvae Using Granular Formulations of Insecticide.

Experiments in larval control of salt-marsh tabanids with granular formulations of insecticide were made on Long Island in 1955 and 1956. The insecticides tested were dieldrin, aldrin, chlordane, heptachlor and DDT. The granules were applied by hand to 60-foot square plots in salt-marshes having high and relatively uniform larval populations. Dieldrin appeared to be the most satisfactory of the insecticides tested.

In addition, in 1956, two areas of about 105 and 232 acres respectively were treated from a helicopter with 2.5 percent dieldrin granules (30/40 Attaclay) applied at the rate of 0.3 lb. per acre (technical). Larval tabanid populations were greatly reduced in both plots. In the smaller plot, which consisted of an entire isolated salt-marsh this reduction was reflected in reduced adult populations. In the larger plot, which was contiguous with untreated marsh, adult tabanid populations remained high.

18. WILSON, H. G., J. C. KELLER, AND CARROLL N. SMITH, Residual Sprays for the Control of House Flies.

Diazinon was the most effective of several organic phosphorus insecticides used as residual treatments for the control of house flies in dairy barns. Deposits of 100 mg. per square foot gave satisfactory control for periods ranging from 1 week to more than a month. Malathion, Bayer L 13/59 (Dipterex), Bayer 21/199, and Dow ET-14 were effective for relatively shorter periods. Duration of effectiveness varied with weather conditions and the amount of fly breeding, but in general the length of control is shorter in Central Florida than in tests reported from other sections of the country.

19. KILPATRICK, JOHN W., H. F. SCHOOF, AND K. D. QUARTERMAN, Organic Phosphorus Compounds for the Control of Resistant House Flies in Dairy Barns.

During 1956, organic phosphorus compounds were evaluated as residual treatments in dairy barns for the control of resistant house fly populations. Formulations included DDVP-Aroclor, Dipterex, Diazinon, Dow ET-15, parathion-DDT, and EPN-DDT. Diazinon and Dipterex formulations were tested with and without a sugar additive.

20. SCHRODER, H. O., AND HOWARD A. JONES, Insecticidal Aerosols Against Resistant House Flies.

A number of household aerosol formulations were tested against the Fowler strain of house flies known



## Section D

to be resistant to certain chlorinated insecticides. Aerosol formulas which depended upon the usual concentrations of DDT, methoxychlor or perthane to obtain kill and which passed knockdown and mortality requirements against normal flies gave relatively low mortalities against the resistant strain of flies even when used at almost three times the official dosage rate. Some resistance to Strobane was also evident. Formulas containing only pyrethrins and piperonyl butoxide, which gave good knockdown and mortality of normal flies, were equally effective against the resistant strain. As house flies and other household insects become more generally resistant to insecticides, a reappraisal by industry of the adequacy of formulas now on the market becomes increasingly important.

21. CHENG, TIEN-HSI, The Use of Electric-Eye-Controlled Sprayer Against Horse Flies and Other Biting Flies on Cattle in Pennsylvania.

A sprayer, controlled by an electric-eye, has been developed for controlling horse, stable and horn flies on both beef and dairy cattle in Pennsylvania. Ten nozzles were so located as to spray all parts of the animal except the head. Spraying time per animal averaged 1-2 seconds. A livestock spray containing butoxypolypropylene glycol, technical piperonyl butoxide, pyrethrins and petroleum oil gave an effective control of horse and horn flies, and a significant reduction of stable flies. Sprays containing methoxychlor, thanite and butoxypolypropylene glycol were also tested in different combinations.

22. CHENG, TIEN-HSI, The Treadle Sprayer and Cable Type Rubber for Controlling Biting Flies on Cattle in Pennsylvania.

A livestock spray containing butoxypolypropylene glycol, methoxychlor, methylated naphthalenes and petroleum distillate was applied by a treadle sprayer and by cable type rubbers to compare the effectiveness of the two methods of application against horn and stable flies on cattle. Tests conducted at University Park, Pennsylvania showed that the cable type rubber, when properly located, gave better results than the treadle sprayer. Additional tests on the effectiveness of cable type rubbers placed in pastures of different sizes and surroundings were made with materials containing the above mentioned and other ingredients.

23. CUTKOMP, L. K., The weight responses of beef cattle in relation to control of horn and stable flies.

Results of the use of different fly spray materials in automatic treadle sprayers are given. Horn fly control was excellent, stable fly control fairly good. Increases in weight of the beef cattle over the untreated cattle are reported.

24. GRANETT, PHILIP AND ELTON J. HANSENS, Further Observations on the Effect of Biting Fly Control on Milk Production of Cattle.

From work done in 1955 on two small farms located in Salem County, New Jersey, there were indications that a significant increase in milk was obtained following the use of livestock sprays based on butoxypolypropylene glycol and methoxychlor. To more firmly establish these findings, a similar study

with sprays and dusts was conducted in 1956 in the same locality. In addition, milk samples were taken for residue analysis. In 1956, the weather was generally wet and cool in contrast to hot and dry conditions the previous season. Pasture and growing conditions this year were consequently more favorable for milk production and the effect of fly control did not appear to be as marked as last year.

25. HOWELL, D. E. AND TONN, R. J., Tests with Dow ET-57 for Ectoparasite Control on Cats and Dogs.

Tests were conducted on 211 animals to determine the effectiveness of Dow ET-57 on ear mites (*Otodectes cynotis*) and three species of fleas, (*Ctenocephalides canis*, *Pulex irritans* and *Echidnophaga gallinacea*). Dow ET-57 was used in capsule form, with and without emulsifier, at approximately 50 ml/kg body weight and as a dip at .25% wettable powder in water. One hundred and sixteen dogs received capsule treatment, 78 dogs and 12 cats were dipped. Two cats and 3 kittens were repeatedly dipped to study the toxicity of Dow ET-57. In all cases of dogs observed, ear mites were not found after treatment with 2% Dow ET-57 in paraffin oil, however, they were observed on 2 cats. The control of fleas varied widely depending on species of parasite and type of treatment.

26. WILSON, H. G., J. C. KELLER, AND CARROLL N. SMITH, Control of Fleas in Yards.

Sprays containing 0.5 or 1 percent of Diazinon, applied at 1 gallon per thousand square feet, were highly effective for the control of fleas in infested yards for more than 2 months. Untreated dogs were kept in the yards during the period. Malathion, Bayer L 13/59 (Dipterex), Am. Cyanamid 4124, Chlorthion, and lindane at 1 percent were equally effective in some tests; Dow ET-14 was slightly less effective. Control was obtained more slowly with chlordane at 1 percent, but once achieved it was maintained for long periods.

27. HORSFALL, WILLIAM R., AND PATRICK T. M. LUM, Artificial Stimulation of Hatching of Latent Eggs of Mosquitoes.

Conditioned eggs of *Aedes* may be caused to hatch artificially provided they are subjected to stimulation by reducing levels of oxygen in the medium. Techniques for producing dependable results have been devised.

28. HORSFALL, WILLIAM R., The Local Distribution of Eggs of *Aedes* Mosquitoes.

Eggs of *Aedes* lie dormant on surfaces of soil subject to transient inundation whenever soil of these areas are cracked or are covered with partially decayed plant debris. Their numbers vary with the horizon in relation to the water table.

29. LUM, PATRICK T. M., AND WILLIAM R. HORSFALL, Maintenance of *Psorophora howardii* (Diptera: Culicidae) as a Laboratory Colony.

This species is predaceous as larvae and must be reared in conjunction with prey species of mosquitoes. Techniques for synchronizing the two have been devised.



## Section E

### Section E: CONTROL, EXTENSION AND REGULATORY ENTOMOLOGY

1. LATTI, RANDALL, Insect Problems in the Marketing of Agricultural Products.

The insect control problems raised by recent developments in handling and processing food products, the new emphasis on marketing research, and the increasing demands for higher levels of sanitation in the food products and the handling facilities, are reviewed.

2. GERBERG, EUGENE J., AND S. L. GOLDHEIM, Weight Loss in Stored Corn and Beans Caused by Insect Feeding.

Three experiments designed to show the quantitative results of insect feeding on stored products are described. On kernels of popcorn that had been infested with Angoumois grain moth, a loss in weight of 10.1% was noted between the infested and the non-infested kernels. In black-eyed beans infested with bean weevils an average weight loss per bean of 68.7% was sustained in 60 days. In navy beans infested with bean weevils an average weight loss of 14.7% per bean was noted in 60 days with an average of 4.2 insects per bean or 3.5% weight loss due to one insect.

3. WHITE, RALPH T., Methods to Prevent Insect Infestation in Whole Black Pepper During Storage and Shipment from the Orient.

Cooperative studies with the American Spice Trade Association showed that insects of concern in arriving shipments of whole black pepper probably originated during the storage of the pepper following harvest, rather than during shipping to the United States. Pepper berries, if properly dried, were found to be unattractive to most stored product insects, but at higher moisture contents both insects and molds thrived. The use of polyethylene liners in the burlap bags used to store and transport pepper berries prevented any appreciable increase in moisture in sun dried pepper during storage through the monsoon season and subsequent shipment to New York.

4. WHITE, GAILEN D., The Practicability of Flotation as a Means of Detecting Internal Insect Infestation in Wheat.

During the past year a number of elevator operators in Kansas have tested the practicability of flotation as a means of detecting whether or not incoming wheat shipments contained internal insect infestation. The procedure tested used two non-miscible solutions of different specific gravities, one containing sodium silicate in water, the other methyl chloroform in kerosene, and was based on earlier laboratory studies. Each operator used the method to test incoming wheat shipments for 2 or more weeks. Determinations under these practical conditions were evaluated at Manhattan by comparison with lots from the same shipments tested by the same flotation process and viewed by X-ray photography. The flotation determinations agreed closely with each other and with the radiographic examination. The tests were in cooperation with the Sanitation Committee, Association of Operative Millers.

5. WALKER, DAVID, ROBERT HARWOOD, AND KERMIT GROVES, Determining Insect Populations in Empty Grain Bins by the Use of  $P^{32}$ .

Lots of 1,000 red flour beetles each tagged with  $P^{32}$  labeled phosphate were released in empty grain bins

which were subsequently sprayed with DDT as a residual spray. Tagged insects were recovered from 17 of the 30 bins so treated in 1955 and from 9 of the 34 bins in 1956. The actual numbers of insects originally in the bin were calculated on the basis of the ratio of the number of radio-active insects recovered to the total number of insects recovered. Considerable variation was found in the numbers of insects and the various species in different bins.

6. CONNOLA, D. P., W. E. WATERS, AND W. E. SMITH, The Development of Sequential Sampling for Forest Tent Caterpillar Survey in New York.

The paper deals with a recent forest tent caterpillar outbreak and the egg mass survey methods tested for use in correlating egg deposit with subsequent defoliation. Data collected by one of the methods were used in developing a sequential method of sampling. The sequential plan was then tested on old data for accuracy in predicting foliage damage and was found to agree favorably with the limits of error set up for the plan. Man hours required to complete an egg mass survey showed that the sequential method would have saved 87 percent in man hours had it been available for use during the early part of the outbreak.

7. DENMARK, H. A., H. V. WEEMS, JR., AND CARLIS A. TAYLOR, A System for Coding Insects and Hosts for Machine Keysort.

Workers in various fields of endeavor long have recognized the need for a method of extracting data rapidly and accurately. The Entomology Department of the State Plant Board of Florida and the Statistical Laboratory of the University of Florida have jointly adopted an open-ended coding system that is presently in use. The open-ended code does not call for the regimentation of a phylogenetic or alphabetic arrangement, but names are added at random. The code does not replace the binomial nomenclature system, but supplements it.

The Plant Board is in a position to summarize data by distribution, infestation, and host records. The system permits statistical analyses of large masses of data and a rapid exchange of information between organizations. The system lends itself to adoption on an international scale.

8. DEKLE, G. W., Mass Production Techniques for Embedding Fruit Flies in Plastic.

During the recent invasion of the Mediterranean fruit fly into Florida, over 2,500 Mediterranean fruit flies have been prepared by the State Plant Board of Florida for distribution to plant inspectors, employees, county agents, experiment station workers, pest control operators, production managers, and others interested in the Mediterranean fruit fly eradication program. Kodachrome slides of embedding procedures, showing equipment and materials used, will be shown and discussed.

9. DAVIS, WILLIAM C., CHARLES LINCOLN, AND DAVID VALINSKY, Quality Control Techniques Applied to Measure the Effectiveness of Organic Insecticides.

Seventeen hundred questionnaires were taken by interview from cotton farmers chosen by stratified random sample. Answers were coded and punched into IBM cards for analysis. The technique appears to have a considerable area of adaptation to analysis of field problems in entomology.

## Section E—Section F

10. HILCHEY, JOHN D., A Review of the Uses of Ionizing Radiation in the Disinfestation of Foods.

Efficient removal of insects from foods has long been a continuing aim of producers and processors. Chemical treatments, though satisfactory, may create problems of residue removal, and mechanical means of removing living insects are often highly inefficient and occasionally ineffective. The effects of ionizing radiations on viability, development, reproduction, longevity and respiration of insects indicate that application of ionizing radiations to problems of insect control may yield useful results. However, the state of development of such control measures is not advanced. Much research must be carried out on the radiation doses needed, design of equipment, and cost of operation before these methods are truly feasible for commercial application.

### Section F: CHEMICAL CONTROL INVESTIGATIONS

1. JENKINS, DALE W., Field Assessment of Airplane Sprays with Radioisotopes.

Abstract not received.

2. BIELARSKI, R. V., J. S. ROUSSEL AND D. F. CLOWER, Biological Studies of Boll Weevils Differing in Susceptibility to the Chlorinated Hydrocarbon Insecticides.

Biological studies of boll weevils differing in susceptibility to the chlorinated hydrocarbon insecticides were conducted to determine if the development of resistance had an effect on oviposition and duration of the developmental period.

3. ROUSSEL, J. S. AND D. F. CLOWER, The Status and Control of Chlorinated Hydrocarbon Resistant Boll Weevil in Louisiana.

The area infested with resistant boll weevil and present control recommendation are discussed.

4. TIPPINS, H. H., AND C. M. BECKHAM, Control of *Hypera meles* in Crimson Clover.

The results of two years' experiments in insecticidal control of *Hypera meles* are reported. Good control and seed yield increases were obtained with aldrin, dieldrin, heptachlor, and methoxychlor. Granulated heptachlor gave the best control and highest seed increases.

5. BLACKBURN, NORRIS D., The Effects of Some Insecticidal Materials on the Larval Population Levels of the Alfalfa Weevil, *Hypera postica* (Gyll.) in Southern Pennsylvania.

Data on the larval populations observed at weekly intervals after application of various insecticides on alfalfa are presented. Extremely low population levels were observed on plots treated with granular heptachlor in early spring at a somewhat higher rate of application than that employed in subsequent treatments with emulsifiable concentrates.

6. HANSEN, H. L., AND C. K. DORSEY, Effects of Granular Dieldrin and Heptachlor on Adult Weevil Populations in Red Clover.

Adult populations of the clover root curculio, *Sitona hispidula* and the lesser clover leaf weevil, *Hypera nigrirostris* were reduced in excess of 90%

by an early season application of dieldrin or heptachlor granules on the surface of the ground.

7. TUTTLE, D. M., V. D. ROTH AND L. A. CARRUTH, Status and Control of the Spotted Alfalfa Aphid in Arizona from 1954-1956.

A review of the occurrence and injury of the spotted alfalfa aphid in Arizona with a summary of tests of thirty-three insecticides used in control treatments of seeds, soil, seedlings and foliage of alfalfa.

8. HUDDLESTON, ELLIS W., AND GEORGE G. GYRISCO, Effects of Sun, Wind and Rain on DDT Spray Residues on Alfalfa.

An investigation of the effects of the weather components on DDT spray residues will be reported. By using specially constructed cages which were placed over heavily sprayed alfalfa the weathering action of sun, wind and rain, separately and in combination were studied.

9. ASHDOWN, DONALD, Factors in Greenbug Control in the High Plains Area.

Organic phosphorous compounds have been most successful in greenbug control. Temperature, soil moisture, and weather limitations are discussed. Timing in reference to greenbug populations and other factors is evaluated.

10. RILEY, G. B., Evaluation of Thrips Attack on Irrigated Corn in Mexico.

This paper is the report of investigations conducted by the Oficina de Estudios Especiales, S.A.G., for the evaluation of the factors contributing to reduced yields of corn grown under irrigation in Mexico. Laboratory experiments of randomized plot design were used to determine the efficacy of thrips control by chemicals. From the materials tested DDT, chlordane, toxaphene, parathion and nicotine sulfate were tested in larger, field experiments. Though control of thrips was excellent by many of these materials, effects on yield were inconclusive. There appeared no varietal difference in resistance or tolerance of thrips attack. Hybrid varieties tested yielded 25% to 30% more than did native varieties. Agronomic practices such as method of irrigation, fertilizer application, and time of planting appeared much more important in insuring yields than did the control of thrips. In the heavy clay soils used in these tests heavy applications of chemical fertilizers, planting about March 15, and the administration of frequent, light irrigations gave the best yields.

11. STRONG, R. G. AND W. A. RAWLINS, Field Experiments with Insecticides to Prevent Lettuce-Yellows Infection from Viruliferous Six-spotted Leafhoppers, *Macrostelus fascifrons* (Stal.)

DDT, malathion, parathion, and Systox insecticide sprays were tested for leafhopper control and lettuce-yellows prevention. Small plot experiments failed to differentiate effectiveness among treatments. A large plot experiment was not entirely satisfactory for this purpose either, presumably due to a small proportion of infective leafhoppers in the population.

The need for better control over leafhopper populations led to an experimental procedure where small areas of lettuce were caged and infested with viruliferous insects. Differences were found between insecticides when lettuce was exposed to viruliferous leafhoppers within two hours after spraying. Insecticides had little effect three days after spraying.

## Section F

12. COX, H. C. AND T. A. BRINDLEY, Time of Insecticide Applications in European Corn Borer Control.

Egg deposition, egg hatching, moth emergence, plant height, leaf damage, temperature accumulation, and tassel bud-plant height ratio were studied in relation to insecticidal control of the first-brood European corn borer for a period of six years. All of the different methods studied varied in effectiveness for predicting time of application from year to year.

13. COX, H. C., J. E. FAHEY, AND T. A. BRINDLEY, European Corn Borer Control in Relation to Malathion Residues.

The use of malathion for control of the European corn borer was studied on field corn in 1954 and 1955. Sprays prepared from wettable powder formulations gave significantly better borer control than sprays prepared from emulsifiable concentrates. Malathion granules were no better than emulsions. Emulsion sprays deposited more residue than wettable powder sprays, but the residues from emulsions were less persistent. Residues from granules were slightly more persistent than residues from emulsions. However, there was considerably less residue on the plants after treatments with granules. Practically all the residue following the application of any formulation was lost in five days. Borer control was related to the number of newly-hatched larvae on the plant at the time of insecticide application.

14. RUPPEL, ROBERT F., Present Status of the Control of the Fall Armyworm in Corn in Colombia.

The fall armyworm, *Laphygma frugiperda*, is the most serious pest of corn in Colombia. Sprays of aldrin, heptachlor or isodrin applied at the dosage of 0.5 kilos per hectare, endrin or parathion at 0.25 kilos per hectare, or toxaphene at 2 kilos per hectare will give an excellent control of this pest. Dusts have been of little value in killing the budworm form of *Laphygma*, but a 5 percent toxaphene bait has proved very good. To be effective, a series of applications of the sprays or baits must be applied between germination of the crop and the time that the plants are about 50 to 60 centimeters tall.

15. EDEN, W. G., Report on the National Corn Earworm Experiment for 1956.

A cooperative experiment on control of the corn earworm, *Heliothis zea*, in sweet corn was conducted in several states in 1956. The experiment was coordinated by J. W. Ingram, Entomology Research Branch, State College, Mississippi. The purpose of the experiment was to determine the influence of intervals between applications of DDT spray on control of the corn earworm. A statistical analysis of the data is presented.

16. GUYER, GORDON, The Bionomics and Control of the Maggot Complex Associated with Spinach.

During 1954, 55 and 56 an investigation of the biology and control of the maggot complex associated with the crown of spinach has been conducted at Grant, Michigan. Six families of flies represented by 10 species have been reared from infested spinach. Observations on the seasonal composition and biology of the maggot population is reported. Both soil and foliar insecticide treatments have been evaluated for control of this maggot complex. Preliminary results indicate that soil treatments were not effective for control of this infestation. Granu-

lated materials were more effective than spray applications. The chlorinated hydrocarbon insecticides were more effective than phosphate materials. Residue information is presented for the insecticide applied.

17. HARRIS, EMMETT, JR., AND W. A. RAWLINS, Control of the Carrot Rust Fly, *Psila rosae*, in New York.

Periodically the carrot rust fly is a serious pest of muckland grown carrots in New York State. Seed treatments and furrow drenches were effective against the first generation maggots but failed to protect carrots from the second generation. Soil treatments broadcast before planting and tilled into the soil were most promising as a means of suppressing both generations.

18. LONG, W. H., AND J. H. LILLY, Effects of Insecticide Seed Treatments on Wireworm Activities.

The results of laboratory tests to determine the effectiveness against wireworms of aldrin, dieldrin, heptachlor and lindane seed treatments are presented. The movements of Cobalt 60—tagged wireworms were recorded to determine whether or not measurable orientation differences could be attributed to treatment effects.

19. SMITH, E. H., Rearing of the Plum Curculio and its Use in Biological and Toxicological Studies.

The method employed in continuous laboratory rearing is described. The results of biological studies comparing the native and laboratory strains are reported. The technique employed in laboratory screening is discussed and results reported using a number of experimental and recommended insecticides.

20. SNAPP, OLIVER I., Plum Curculio Control with Soil Insecticides.

Aldrin was very effective against the plum curculio during its immature stages for a period of at least 4 years after it was worked into the soil. Dieldrin was a little more effective than aldrin during the fourth year, but less effective during the first three years. Heptachlor was very effective for at least three years, and chlordane was effective for at least a year. Isodrin was comparatively ineffective. The results from soil plot tests were confirmed in large-scale peach orchard tests.

21. HAMILTON, D. W., AND M. L. CLEVELAND, Experiences with Ryania for Control of Codling Moth and other Apple Pests.

Ryania was evaluated for codling moth control in 1945 and found highly effective but less so than DDT. It was reevaluated for codling moth control in 1953 and has been tested annually since that period. In 1955 and 1956 it equaled or excelled DDT, possibly because of the development of resistance by the codling moth to DDT. Ryania is relatively ineffective for controlling pests of apple other than the codling moth, such as orchard mites, plum curculio and red-banded leaf roller. Large scale orchard experiments suggest that some pests may be held in check by ryania, owing to its low toxicity to predaceous forms of mites and insects that feed on them. Leafhoppers, however, tend to increase more in ryania plots than in DDT plots.



## Section F

22. FAHEY, JACK, D. W. HAMILTON, AND H. W. RUSK, Relationship of Spray Mite to Residues of Chlorinated Hydrocarbon Pesticides in Peaches.

The residues of five chlorinated hydrocarbon pesticides in peaches were studied following spray applications made 40, 30, 20 and 10 days before harvest. DDT, chlordane, or dieldrin residues from sprays applied to peaches less than 40 days before harvest could be expected to exceed the present tolerances. Heptachlor spray applied 30 days before harvest left a residue of less than 0.1 p.p.m. Endrin spray applied 30 days before harvest left a residue of less than 0.1 p.p.m. of chlorine.

23. BECKER, W. B., AND H. G. ABBOTT, Effect of BHC Emulsion Sprays on the Insect Invasion of Hurricane-Felled Pine Logs and the Grade-Yield of the Resulting Lumber.

In eastern Massachusetts, logs from white pine trees that had been felled by a September 1954 hurricane were individually sprayed, in the early spring of 1955, with a BHC emulsion that contained 0.4 percent gamma isomer by volume. The treatment greatly reduced invasion by bark and wood boring insects through the autumn of 1955 and there was no downgrading of the resulting lumber due to worm holes. The grade-yield of the lumber from the sprayed and unsprayed logs is compared.

24. GARMAN, PHILIP, A Study of a Flow-Meter for Determining Rates of Flow in Spray Machines.

Because of difficulty of determining rates of flow in available machines, experiments were begun with a type of flow meter which measures this item. Gallons per minute depends on nozzle size and number, pressure in p.s.i., and pump capacity. The overall effect of these is directly measured by the meter as described and figured.

25. GARMAN, PHILIP, AND HENRY HURLBURT, Further Study of Ground Fauna in Connection with Fruit Tree Sprays.

This is a continuation of the work reported last year. The main points covered are that there are great differences between soil under unsprayed and sprayed trees and that there are many more predator species as well as parasites with some treatments or no treatment. The occurrence of *Oribatei*, as well as *T. telarius* and *B. practiosa* reflects the removal of predators and may account for the common upsurge of the last two in commercial orchards.

26. EL GHAR, MOHAMED RAMADAN ABO, AND H. BRUCE BOUDREAU, Comparison of Responses of Various Stages of Five Species of Spider Mites to Four Acaricides.

Parathion, aramite, sulfurs and Niagara Experimental Compound 1137 were tested for effectiveness in killing the eggs, nymphs and adults of these species of the mite genus *Tetranychus*: *desertorum*, *cinnabarinus*, *lobosus*, *gloveri* and *tumidus*, all in the laboratory. Eggs were the most resistant stage. Other stages varied according to species and to acaricide. Parathion was the most effective acaricide, with sulfur the least effective. Aramite and compound 1137 exhibited similar properties. On the basis of behavior, the five species show relationships similar to those pointed out by various authors based upon morphology.

27. RODRIGUEZ, J. G., H. H. CHEN, AND WALTER T. SMITH, JR., The Effect of Soil Insecticides on Plants and the Resulting Effect on Mite Nutrition.

The effects of DDT, aldrin, dieldrin, chlordane, BHC and lindane in the soil on such plants as beans, cotton and soybeans were studied along with the resulting effect on mite development. Apple trees also were included in the studies; parathion and some of the other materials already mentioned were studied. Data on plant growth show that treatment of the soil may stimulate or depress growth, depending upon the amount and kind of insecticide used. Some effects of insecticides on mite populations were noted; the most consistent effect was the depression of populations by extremely high levels of BHC and lindane. Analyses of N, P and K showed that they were influenced but little by insecticide treatment, as were the amino acids which commonly occur in plants. Studies with sugars were more revealing; addition of chlorinated hydrocarbons increased glucose content of the foliage.

28. CHAPMAN, P. J., S. E. LIENK AND WILLIAM SHEA, The Influence of Viscosity on the Ovicidal Efficiency of "Superior" Type Spray Oils Against Winter Eggs of the European Red Mite.

A viscosity range of 90 to 120 seconds Saybolt at 100° F. is included in current specifications of the so-called superior type dormant tree spray oils. In tests of lighter fractions of comparable structural composition, relatively narrow boiling fractions ranging down to 70 seconds were fully as effective as standard superior oils in killing winter eggs of the European red mite, *Metatetranychus ulmi*. A 60-second product was almost as effective.

29. TAYLOR, EDGAR A., FLOYD F. SMITH, AND W. D. MCCLELLAN, Variation in Toxicity of Malathion in Dust Mixtures to Two-Spotted Spider Mites.

Field experiments in 1954 and 1955 on roses infested with two-spotted spider mites with dust mixtures containing malathion and fungicides indicated an interaction with the captan combinations. In further tests during 1956 with dust mixtures against the same strain of spider mites on lima beans, DDT and captan had no direct influence on malathion whereas attaclay reduced its miticidal effect.

30. DIDRIKSEN, R. A., AND J. H. LILLY, Granular Insecticide Formulations for Soil Insect Control.

No. 4 Vermiculite was compared with 30-60 mesh RVM Attaclay as a carrier for soil insecticides. Aldrin, dieldrin, heptachlor, and endrin were formulated on these carriers at concentrations of 2, 5, 10, and 20% on both Attaclay and Vermiculite, and 30 and 40% on Vermiculite. In laboratory tests with wireworms, it was found that the lower concentrations of granular insecticides were more effective than the higher ones at the same rates of actual toxicant per acre, i.e., increasing the number of granules per unit area of soil gave corresponding increases in wireworm kills.

31. HETRICK, LARRY A., Ten Years of Testing New Organic Insecticides as Soil Poisons Against the Eastern Subterranean Termite, *Reticulitermes flavipes* (Kollar).

Although still residually toxic in sandy soil after 10 years, dilutions of BHC and chlordane have



## Section F

shown decreasing speed of action. Dilutions of Aldrin, dieldrin, and heptachlor have remained effective for more than 7 years in these tests.

32. OSMUN, JOHN V., Laboratory Techniques for Evaluating the Effect of Soil Insecticides on the Subterranean Termite.

Using the eastern subterranean termite, *Reticulitermes flavipes*, a series of convenient methods was developed to compare short and long exposures to chemically treated soil, the importance of repellency, and the extent of vapor action. The results obtained with several insecticides indicate a wide range of susceptibility to various chemicals. The techniques described should greatly shorten the time required to screen termite control materials.

33. LICHTENSTEIN, E. P., Insecticidal Residues in Soils.

Three soil types (muck, loam and sandy loam) were treated in Wisconsin in 1954 with aldrin, lindane and DDT in three different concentrations. Residue analyses of these soils were made in 1954, 1955 and 1956. Depletion data for a 2½-year period will be presented and the influence of these soil types on the persistence of the insecticides will be discussed. About 90% of the insecticides recovered was located in the upper 3" layer of the soil. Cucumbers and carrots were used in 1956 as indicator plants on these plots. The results of a survey on DDT contaminated soils will be presented.

34. LICHTENSTEIN, E. P., Persistence of Insecticides in Soils Under Controlled Conditions.

Under laboratory conditions, Plainfield sand, Miami silt loam and muck were treated with aldrin and kept at room temperature. Aldrin depletion data in these soil types will be given for a period of 56 days. Loam, treated with aldrin, was exposed to various temperatures and the persistence of the insecticide was studied as influenced by temperature and moisture. A volatile growth regulator released by soils treated with insecticides was measured quantitatively, using excised lupine roots as test plants.

35. RICHARDSON, HENRY H., AND H. ROTH, Methyl Bromide Fumigation of Fruit Under Plastic Tarpaulins and at Cold Temperatures.

Methyl bromide gas distribution and other tests were made on some commercial fumigations of plums and other fruit stacked under plastic tarpaulins on covered barges, at temperatures near 40-45° F. The tarpaulin was an 8-gauge polyvinyl plastic material and was held to the double wooden floor of the barge by means of sand snakes. Some small scale laboratory fumigations near 45-50° F. indicated plums had a good margin of tolerance to the methyl bromide.

36. KENAGA, E. E., Laboratory Studies of Sulfuryl Fluoride as an Insecticidal Fumigant.

The use of sulfuryl fluoride as an insecticide fumigant is discussed. The effect of variations in temperature, exposure period and dosages of sulfuryl fluoride on several insect species and life stages is given. The penetration characteristics of sulfuryl fluoride are superior to methyl bromide in the commodities which were used for these experiments.

37. GORE, K. S., AND H. H. SCHWARDT, Laboratory Tests with Malathion as a Wheat Protectant.

Malathion in spray form added to wheat at dosages as low as 10 ppm gave complete protection against granary weevils for three months. During the same period check samples were totally ruined by the weevils. At the end of the three month period wheat treated at the 10 and 20 ppm levels contained an average of less than 2 ppm of malathion residue. Using the same techniques malathion dusts at dosages of 2½, and 5 ppm were ineffective against the granary weevil.

38. WALKER, DAVID, The Use of Residual Sprays for Controlling Stored Grain Insects in Washington.

Wettable formulations gave better control than emulsions in bin studies. Residual sprays gave only slight control over an extended period, and their usefulness can be considered as primarily a retarding effect. The red flour beetle, *Tribolium castaneum* (Hbst.), was the most tolerant of the species tested. Emulsions ranged in effectiveness in the following descending order in laboratory tests: DDT, malathion, Rhothane, methoxychlor, and pyrethrins.

39. TRACEY, RALPH L., JOSEPH GENTILE, AND J. M. WENNEIS, Concentrations of DDVP Insecticidal For The Cigarette Beetle.

The unique volatility of dimethyl dichloro vinyl phosphate (DDVP) suggested that this insecticide might be used advantageously for insect control in certain types of warehouses. A study was made to determine in the laboratory the minimum lethal concentration of DDVP for the cigarette beetle, *Lasioderma serricorne*, by direct contact and by vapors, and to establish the mammalian toxicity of these concentrations. It was found that 0.25 mg. of DDVP per liter was lethal by direct contact and by vapor for a period of 5 days when exposures of 24 hours were used. For 48 hours, 0.0625 mg./liter was lethal. The levels of whole blood cholinesterase of white rats exposed only to vapors in test chambers treated with 0.25 mg. of DDVP per liter remained normal after continuous exposures of 24 to 120 hours.

40. MATTHYSSE, JOHN G., Research on Insecticidal Control of Philippine Crop Pests.

Recent research in control of Philippine crop pests conducted by the University of the Philippines College of Agriculture, Los Banos, in furtherance of the International Cooperation Administration-Cornell University Contract. Some results from application of newer insecticides to rice, corn, sugar cane, abaca, citrus, lanzones, cacao, and vegetables. Discussion of application machinery for use on rice.

41. KOEHLER, C. S., AND GEORGE G. GYRISCO, The Systematic Action of Lindane in Alfalfa upon the Meadow Spittlebug.

In experiments using the meadow spittlebug as a test insect, it was found that lindane is capable of acting as a systematic insecticide when applied to alfalfa foliage or to the soil in which alfalfa is growing. In some cases, systematic action persisted for a period of at least six weeks. All experiments were conducted under conditions which eliminated the possibilities of fumigant and contact action from interfering with systematic action.

# SUSTAINING ASSOCIATES

## ENTOMOLOGICAL SOCIETY OF AMERICA

**Agricultural Chemicals, Inc.**  
Llano, Texas. 1955-1956

**Birds Eye Division**  
General Foods Corp.  
White Plains, N. Y. 1955-1956

**California Spray-Chemical Corp.**  
Lucas & Ortho Way  
Richmond, Calif. 1956

**Chemagro Corp.**  
101 Park Ave.  
New York 17, N. Y. 1955-1956

**Colloidal Products Corp.**  
2598 Taylor St.  
San Francisco 11, Calif. 1956

**The Dow Chemical Co.**  
Agricultural Chem. Div.  
American Legion Bldg.  
Midland, Mich. 1956-1957

**E. I. du Pont de Nemours Co., Inc.**  
Agricultural Service &  
Development  
Grasselli Chemicals Dept.  
Wilmington 98, Del. 1955-1956

**Eastern State Farmers Exchange, Inc.**  
26 Central Street  
West Springfield, Mass. 1956

**Fairfield Chemical Div.**  
Food Machinery & Chem. Corp.  
420 Lexington Ave.  
New York 17, N. Y. 1956

**Farmers Cooperative Exchange, Inc.**  
Statesville Wholesale Service  
Statesville, N. C. 1956

**G. L. F. Soil Building Service**  
Div. of Coop. G.L.F. Exchange,  
Inc.  
Ithaca, N. Y. 1955-1956

**The Gardening Council**  
Newark, N. Y. 1956

**Geigy Agricultural Chemicals**  
Div. of Geigy Chemical Corp.  
62 West 2nd Street  
Bayonne, N. J. 1956

**General Chemicals Division**  
Allied Chemical & Dye Corp.  
40 Rector St.  
New York 6, N. Y. 1955-1956

**Gulf Oil Corp.-Gulf Refining Co.**  
Gulf Bldg.  
Pittsburgh 30, Pa. 1955-1956

**H. J. Heinz Company**  
Medina, N. Y. 1955-1956

**Hercules Powder Co.**  
Agricultural Chemicals Div.  
Naval Stores Dept.  
Wilmington 99, Del. 1955-1956

**Jackson & Perkins Co.**  
Newark, N. Y. 1955-1956

**Merck and Company, Inc.**  
Chemical Div.  
Rahway, N. J. 1956

**Minerals & Chemicals Corp. of America**  
210 West Washington Square  
Philadelphia 5, Pa. 1956

**Monsanto Chemical Co.**  
800 N. 12th Blvd.  
St. Louis 1, Mo. 1956

**Niagara Chemical Division**  
Food Machinery & Chem. Corp.  
100 Niagara St.  
Middleport, N. Y. 1955-1956

**S. B. Penick & Co.**  
50 Church St.  
New York 8, N. Y. 1955-1956

**Pennsylvania Farm Bureau**  
Cooperative Assoc.  
3609 Derry St.  
Harrisburg, Pa. 1955-1956

**Port Fertilizer & Chemical Co.**  
P. O. Drawer W  
Los Fresnos, Texas 1955-1956

**R. J. Reynolds Tobacco Co.**  
Winston-Salem, N. C. 1956

**Rohm & Haas Co.**  
222 W. Washington Square  
Philadelphia 5, Pa. 1955-1956

**Shell Chemical Corp.**  
Agricultural Chemicals Sales  
Div.  
460 Park Ave.  
New York 22, N. Y. 1955-1956

**Southern Agricultural Insecticides, Inc.**  
Box 324  
Palmetto, Fla. 1956

**Stauffer Chemical Co.**  
380 Madison Avenue  
New York 17, N. Y. 1955-1956

**Superior Fertilizer & Chem. Co.**  
P. O. Box 1021  
Tampa 1, Fla. 1956

**Thompson-Hayward Chem. Co.**  
2915 Southwest Blvd.  
Kansas City 8, Mo. 1956

**The Triangle Co.**  
P. O. Box 1289  
Salinas, Calif. 1956

**Union Carbide & Carbon Corp.**  
32 East 42nd St.  
New York 17, N. Y. 1955-1956

**United Fruit Co.**  
Research Dept.  
80 Federal St.  
Boston 10, Mass. 1955-1956

**Velsicol Chemical Corp.**  
330 East Grand Ave.  
Chicago 11, Ill. 1955-1956

**Willson Products Division**  
Ray-O-Vac Co.  
Reading, Pa. 1956

**Woolfolk Chemical Works, Ltd.**  
P. O. Box 922  
Fort Valley, Ga. 1956

